

GOVERNMENT OF GUAM – Department of Land Management
Office of the Recorder

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Deputy Recorder: Janet Yamasaki
JANET YAMASAKI

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ORIGINAL

GUAM LAND USE COMMISSION REGULAR MEETING MINUTES



Department of Land Management Conference Room
ITC Building, Tamuning



Thursday, January 25, 2018
1:40 p.m. to 3:40 p.m. (GLUC)
1:45 p.m. to 3:00 p.m. (MCoG DLM 2018-02)

GUAM/HYBRID LAND USE COMMISSION
Regular Meeting
Thursday, January 25, 2018
Department of Land Management Conference Room
3rd Floor ITC Building, Tamuning

MEMBERS PRESENT:

Mr. Victor F. Cruz, Vice Chairman

Ms. Conchita D. Bathan, Commissioner

Mr. Tae S. Oh, Commissioner

Mr. Hardy T. Vy, Commissioner

Mr. Michael Borja, Executive Secretary

Mr. Nicolas Toft, Legal Counsel

Excused: Chairman John Arroyo

Hybrid Commission:

Mayor Allan Ungacta, Mangilao

Mayor June Blas, Barrigada

Mayor Rudy Matanane, Yigo

Excused: Mayor Melissa Savares, Dededo

PLANNING STAFF PRESENT:

Mr. Marvin Aguilar, Guam Chief Planner

Mr. Frank Taitano, Case Planner

Ms. Celine Cruz, Case Planner

Ms. Cristina Gutierrez, Recording Secretary

GLUC/HYBRID LAND USE COMMISSION GUAM SEASHORE PROTECTION COMMISSION Attendance Sheet

Department of Land Management Conference Room
590 S. Marine Corps Drive, Third Floor, ITC Building, Tamuning

Date of Meeting: Thursday, January 25, 2018

Time of Meeting: GLUC: 1:40pm GSPC:
Hybrid: 1:45pm

| | |
|-------------------------------------|-----------|
| <input checked="" type="checkbox"/> | GLUC |
| <input checked="" type="checkbox"/> | Regular |
| <input type="checkbox"/> | Special |
| <input checked="" type="checkbox"/> | Quorum |
| <input type="checkbox"/> | No-Quorum |

| | |
|-------------------------------------|-----------|
| <input checked="" type="checkbox"/> | HLUC |
| <input checked="" type="checkbox"/> | Regular |
| <input type="checkbox"/> | Special |
| <input checked="" type="checkbox"/> | Quorum |
| <input type="checkbox"/> | No-Quorum |

COMMISSION MEMBERS

SIGNATURE

Chairman John Z. Arroyo

Vice Chairman Victor F. Cruz

Commissioner Conchita D. Bathan

Commissioner Tae S. Oh

Commissioner Hardy T.I. Vy

HYBRID COMMISSION: LZ COMPANY, APPLICATION NO. 2017-39 (MCoG DLM 2018-02)

Mayor Allan Ungacta, Mangilao

Mayor June Blas, Barrigada

Mayor Melissa Savares, Dededo

Mayor Rudy Matanane, Yigo

Michael J.B. Borja, Executive Secretary

Nicolas E. Toft, Legal Counsel (OAG)

Marvin Q. Aguilar, Chief Planner

Frank Taitano, Planner IV

Penmer Gulac, Planner IV

Celine Cruz, Planner IV

M. Cristina Gutierrez, WPS II

ADJOURNMENT: GLUC: 3:40pm HLUC: 3:00pm

**Location: Department of Land Management Conference Room
590 S. Marine Corps Drive, Third Floor, ITC Building, Tamuning**

(THIS RECORD WILL BE USED IN THE TRANSCRIPTION OF THE GLUC/GSPC MINUTES. PLEASE PROVIDE YOUR FULL NAME AND WHO YOU REPRESENT, I.E., ITEM ON AGENDA.)

[illegible]

**Location: Department of Land Management Conference Room
590 S. Marine Corps Drive, Third Floor, ITC Building, Tamuning**

| | | | | | |
|-------------------------------------|--------|-------------------------------------|-----------|--------------|----------------------------|
| <input checked="" type="checkbox"/> | GLUC | <input checked="" type="checkbox"/> | Regular | Date: | Thursday, January 25, 2018 |
| <input checked="" type="checkbox"/> | HLUC | <input type="checkbox"/> | Special | Time: | 1:40 pm |
| <input checked="" type="checkbox"/> | Quorum | <input type="checkbox"/> | No Quorum | Adjournment: | 3:40 pm |

[illegible]



GUAM LAND USE COMMISSION

Chairman John Z. Arroyo
Vice Chairman Victor F. Cruz
Commissioner Conchita D. Bathan

Commissioner Tae S. Oh
Commissioner Hardy T.I. Vy

Michael J.B. Borja, Executive Secretary
Nicolas E. Toft, Legal Counsel (OAG)

AGENDA

Regular Meeting

Thursday, January 25, 2018 @ 1:30 p.m.

Department of Land Management Conference Room
590 S. Marine Corps Drive, 3rd Floor, ITC Building, Tamuning
[As advertised in the Guam Daily Post on January 4th 2018 and January 9th, 2018]

- I. Notation of Attendance ☐ Quorum ☐ No Quorum
- II. Approval of Minutes
 - GLUC Regular Meeting of Thursday, December 14, 2017
- III. Old or Unfinished Business [Hybrid Commission; MCoG DLM 2018-02]
- IV. New Business [None]
- V. Administrative & Miscellaneous Matters
- VI. Adjournment



HYBRID LAND USE COMMISSION

Chairman John Z. Arroyo
Vice Chairman Victor F. Cruz
Commissioner Conchita D. Bathan

Commissioner Tae S. Oh
Commissioner Hardy T.I. Vy

Michael J.B. Borja, Executive Secretary
Nicolas E. Toft, Legal Counsel (OAG)

AGENDA

Regular Meeting

Thursday, January 25, 2018 @ 1:30 p.m.

Department of Land Management Conference Room
590 S. Marine Corps Drive, 3rd Floor, ITC Building, Tamuning
[As advertised in the Guam Daily Post on January 4th 2018 and January 9th, 2018]

I. Notation of Attendance [] Quorum [] No Quorum

II. Approval of Minutes

- GLUC Regular Meeting of Thursday, December 14, 2017

III. Old or Unfinished Business

Conditional Use

- A. **Application No. 2017-39** Applicant LG CNS America, LLC; Conditional Use request for a renewable energy facility, on Lot 1, Tract 1541, in an "A" (Rural) zone, in the Municipality of Mangilao. **[MCoG_DLM 2018-02] [Continuation – GLUC Hearing of 12/14/2017]**
Case Planners: Frank Taitano/Celine Cruz

IV. New Business [None]

V. Administrative & Miscellaneous Matters

VI. Adjournment

GUAM LAND USE COMMISSION REGULAR MEETING MINUTES
Department of Land Management Conference Room, 3rd Floor, ITC Bldg., Tamuning
Thursday, January 25, 2018 • 1:40 p.m. to 3:40 p.m.

I. Attendance

Acting Chairman Cruz called the regular meeting of the Guam Land Use Commission for Thursday, January 25, 2018 to order at 1:40 p.m., noting a quorum.

Present were: Acting Chairman Victor Cruz, Commissioner Conchita Bathan, Commissioner Tae Oh, Commissioner Hardy Vy, Executive Secretary Michael Borja, Legal Counsel Nick Toft, Chief Planner Marvin Aguilar, Planning Staff Frank Taitano, Celine Cruz and Recording Secretary Cristina Gutierrez.

[Excused – Chairman John Arroyo]

II. Approval Minutes

Acting Chairman Cruz before the Commission is the Minutes from the last GLUC hearing of December 14, 2017.

Commissioner Bathan makes a motion to approve the GLUC Minutes of Thursday, December 14, 2017; subject to corrections of any minor typographical errors.

Commissioner Oh seconds the motion.

Acting Chairman Cruz motion is made by Commissioner Bathan, seconded by Commissioner Oh. All in favor of the motion say “aye” [Commissioner Bathan, Commissioner Oh and Commissioner Vy], all opposed say “nay.”

[Motion passed; 3 ayes, 0 nay. No corrections noted]

III. Old or Unfinished Business [Hybrid Commission]

Acting Chairman Cruz recessed the Guam Land Use Commission at 1:45 p.m.

[The Guam Land Use Commission reconvened at 3:10 p.m.]

Acting Chairman Cruz any new business –

IV. New Business [None]

V. Administrative & Miscellaneous Matters

Marvin Aguilar noted that there will be a push forward of other applications that will be placed on the agenda for February.

Commissioner Oh on the legal opinion submitted by Legal Counsel concerning the applicant Kevin Yang (zone change), in reference to the notification process. After reading this, asking the applicant to start the process from the beginning will be difficult for the applicant. And the with the opposition of some of the Perez Acres homeowners, Commissioner Oh wanted to be clear on this because you are now talking about notifying everyone at Perez Acres because they have 1/200 undivided interest. Moving forward, this will be corrected. In cases on these types of situations, Legal Counsel's opinion and advice is to notify all homeowners of Perez Acres.

Nick Toft responds yes and in any situation where there is a 500-foot radius that includes any part of a Horizontal Property Regime; whether it is Perez Acres, or some upcoming development that decides to use an HPR basis that it would be necessary to notify all members of that HPR.

Commissioner Bathan does that include the LZ application that is located next to Talo Verde.

Nick Toft is Talo Verde have an HPR.

Celine Cruz yes, Talo Verde has the townhomes.

Marvin Aguilar other than being an HPR is it governed by an HOA and to what value do we put the HOA –

Nick Toft it is not the HOA that is the critical point. It is the landowner within a 500-foot radius. And because we cannot say that they do not own land within that 500-foot radius because they own an undivided 1/200th interest in the land that is in that radius that they need to be notified statutorily unless it is amended and have the Legislature say in cases of HPR, notify the President or something like that, but that is not the case.

Michael Borja Talo Verde townhomes is the HPR, not the single-family homes.

Marvin Aguilar it is an association between the two subdivisions.

Michael Borja who owns the land.

Celine Cruz there are two associations; the HOA of the residential area and then there is a sub-organization which is the townhomes' association.

[Discussion ensues on notification of homeowners, fee simple issues, CAFs]

Acting Chairman Cruz all landowners have to be notified.

Nick Toft the problem is that it has to be in the specific manner; otherwise, all subsequent Commission actions are void. The statute is written such that without this mailing of notification everything is still void.

Marvin Aguilar Frank (Taitano) brought out the question on master deeds which is the foundation of ownership before an HPR is approved. It is the way that it is prescribed in the deed when each unit is sold, and for Perez Acres they identified 1/200th.

Acting Chairman Cruz will the applicant have to start the process over or is it just the notification process.

Nick Toft because this is one of the first things that has to be done, the application should be started over. Mr. Klitzkie also pointed out the defect on the name that was noted on the billboard sign being Mr. Yang's name and not the corporation or visa versa. Correct this as well so it does not give him a "foothold to launch an appeal" on the Commission's decision on a technical legal matter. If Mr. Klitzkie wishes to appeal the decision of the Board it is considered more difficult for him to get the Court to overturn the decision.

[Lengthy discussion ensues; other projects in which there were HPRs, HOAs, discussion on the LZ Company's current application before the Commission. In the case of LZ Company, Chief Planner Aguilar will discuss with LZ Company regarding Legal Counsel's opinion.]

Michael Borja briefly discussed the current terms of the Board members to ensure that their terms are current and have not expired, and for those whose terms are expiring to begin the renewal process should they wish to renew.

[Discussion ensues]

VI. Adjournment

Commissioner Bathan motions to adjourn.

Commissioner Oh seconds the motion.

Acting Chairman Cruz motion to adjourn by Commissioner Bathan, seconded by Commissioners; with all in favor.

The meeting of the Guam Land Use Commission for Thursday, January 25, 2018 was adjourned at 3:40 p.m.

Approved by:



Victor F. Cruz, Acting Chairman
Guam Land Use Commission

Date approved:



February 8, 2018

Transcribed by:



M. Cristina Gutierrez, Recording Secretary
DLM, Planning Division

**HYBRID COMMISSION
(MCoG DLM 2018-02)**

ATTACHMENT A

EXHIBIT 1

EXHIBIT 2

ATTACHMENT A



DIPATTAMENTON MINANEHAN TANO'
(Department of Land Management)
GUBETNAMENTON GUAHAN
(Government of Guam)



Street Address:
590 S. Marine Corps Drive
Suite 733 ITC Building
Tamuning, GU 96913

EDDIE BAZA CALVO
Governor

MICHAEL J B BORJA
Director

Mailing Address:
P.O. Box 2950
Hagåtña, GU 96932

RAY TENORIO
Lieutenant Governor

DAVID V. CAMACHO
Deputy Director

January 5, 2018

MEMORANDUM

TO: Chairman, Guam Land Use Commission

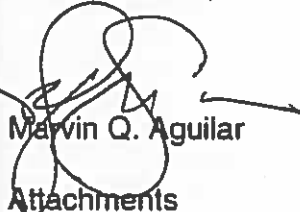
FROM: Guam Chief Planner

SUBJECT: Commission Brief – Application No. 2017-39 Conditional Use
Application for a Solar Plant Photovoltaic Facility on Lot 1, Tract 1541,
Sasayjan, Municipality of Mangilao

On December 14, 2017 the Guam Land Use Commission (GLCU) began it's review of Application 2017-39, however, it was the order of Acting Chairman, Mr. Victor Cruz, that deliberation be continued as noted in the attached GLUC Agenda Disposition.

The applicant in response to the results of the December 14, 2017 meeting, submits the attached Supplement #3 addressing the issues brought up by the Commission.

Senseramente,



Marvin Q. Aguilar

Attachments

Case Planners: Frank Taitano and Celine Cruz

Website:
<http://dlm.guam.gov>

E-mail Address:
dlmdir@land.guam.gov

Telephone:
671-649-LAND (5263)

Facsimile:
671-649-5383



Belta Perez
P.O. Box 96
Hagatna, Guam 96932

TO: Government of Guam

RE: A personal observation hopefully to bring together an appreciation for the value of saving Sasayan Valley , as a nature valley.... (Att. 2 pgs)

I truly believe in the tradition and conviction that our native people value the following "A unique people and its unique history are one in the land". Chamoru natives only indigenous homeland traced its roots in the Mariana Islands.

And as this generation of caretakers for our future generations, we need to appreciate our natural environment in all its totality as we forge into the 21st Century of Modernization.

Pristine Sasayan Valley's 900 acres is the last of Guam's natural wonders of Coastal East with a history to the land.

Please save Sasayan Valley!

Sincerely yours,



Belta Perez
A Native-born Citizen of Guam

RE: A personal observation hopefully to bring together an appreciation for the value of saving Sasayan Valley , as a nature valley...

Thank-you for the opportunity to speak on December 14, 2017 at the GLUC Public Hearing.

The following are important matters from the November 7, 2017 Mangilao's Mayor's public hearing pertinent to a Solar Plant proposal before GLUC, I wish I had been given prior notice to respond before that first public hearing. Due to the fact that I am directly connected to this proposed 60MW ,175 acres Solar Plant.

The people who enjoy the area as landowners, farmers,/residents, guests and tourists who will have to share the same easement dealing with the daily up ground exposure to a Solar Plant. It is a devastating possible reality for this pristine panoramic nature gift of God enclave as the landscape will be changed forever. And it is possible that it could matter to people's health and safety concerns, which were not answered back then. No assurances can be given to the audience by the orientation presenters.

1. A response to these concerns was published in a December 1, 2017 Developer's handbook. "According to their Company opinion, there are no Safety concerns. Perhaps the following experience will help understand the nature of the valley not covered in the developer's proposal. As a former Lot 1 resident of the Valley in past years living in a Quonset metal building, we found the Valley sometimes very windy due to the strong coastal Marianas Trench winds that blow inland against the mountain. During one strong banana storm the winds had difficulty going up the enclosed mountain, resulting in forming little wind funnel-like swirls at the bottom of the mountain. We rushed our family out of the valley to safety elsewhere. We could not fight mother nature. Nor predict her possible wrath at the time.

2. The natural spring under water, inside Marbo Cave and adjacent to Lot No. 1 was our main source of supplemental water supply to the rain water used. It slops down to the aquafer. Will this have an impact on the runoff to the ocean from solar waste? The prevailing frequent rains can easily carry the waste as these solar panels are exposed up ground.

3. As the valley faces the Marianas Trench, perpetually, giant bold ocean waves spray a lot of salt water onto our properties. Like the rain, will this spray have an effect on the solar panels, being exposed to the elements of nature? It is hard to avoid the ocean sprays carried by the coastal winds.

4. This coastal fish and wildlife waterfront has an abundance of the best fishing anywhere in an unpolluted environment. The spectacular view is captivating and so breath-taking to the senses of its beauty. A drive down will take your sense of wonders to another level, so beautiful. Similar to my road trip drive down the East Coast of our nation in the mainland.

Therefore, I am appealing to some sense of reality check for Sasayan Valley as not the best site land use for a Solar Plant. The Valley's volatile unpredictable weather and natural environment scenarios can be an impediment for a sustained Solar Plant.

Our limited natural land resources deserve our upper most priority as 60 MW voltage of heat will certainly have an effect on the overall mountain enclosed posture of the Valley. The Solar Plant's high concentrate of close knit solar panels will store the heat. Hopefully health, safety and welfare of people will never be in jeopardy. As for the remaining 700 acres owned by others in the Valley, we all must travel on the same easement joint use, a very uncomfortable daily situation to be.

I have nothing against GPA, or its developers. This personal letter is a plea to re-think their moves!

Respectfully submitted,



Belta Sgambelluri Perez
Concerned Adjacent Neighbor
Certified Farmer w/ Dept. of Agriculture

Other sources of interest:

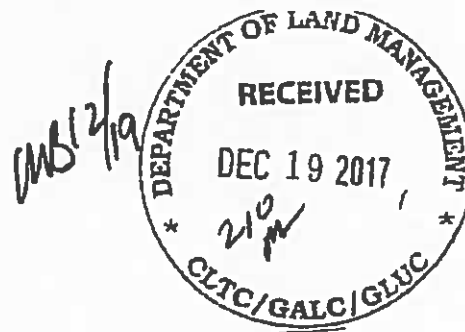
Our forefathers always taught us to respect the land as the Stewards of our tiny island.

Scientifically, long-term, could this project contribute to Global Warming. In the Pacific?

Based on timeforchange.org/effects_of_global_warming meaning increase in heat for our planet. Probably an eye-opener to future Irreversible consequences of modern technology vs green natural uses of energy at the expense of not saving priceless acres of valuable trees and fauna needed to balance the growth of our modern technology. Reason why Solar Plants are best located in desert-like environment, old landfills, dead unusable large parcels, abandoned agricultural garbage dumps (Ron Heinginer) away from people for their sustainable use according to studies as this. God bless our Sasayan Valley meaning Fertile Valley of a documented "Antigo Na Chamorro Village that once occupied the Valley (Kaiser/Aetna Honolulu and Sobhu Golf, Tokyo) archeological finds after first discovered by my grandfather, Marcelo Sgambelluri, original owner of Sasayan Valley. Thank you

December 14, 2017

Mr. John Arroyo
Chairman, Guam Land Use Commission
c/o Department of Land Management
P.O. Box 2950
Hagatna, Guam 96932



Re: Application No 2017-39 for a Solar Farm Development in the Sasaiyan Valley

Dear Mr. Arroyo:

As a representative of the owner of Lot No 5354-3A-6-R1-1, the Estate of Irene Walters Camacho, I respectfully submit the following testimony relating to the Solar Farm development in the Sasaiyan area.

While I support the intent to develop sustainable alternative energy solutions for Guam, I am opposed to this development in "our" valley for the following reasons:

1. The Eduardo and Irene Camacho family owns 105,560 square meters or 26.39 acres, and has medium to long-range goals to develop our properties as a residential community.
2. Our property is situated immediately adjacent to the proposed development site.
3. The adjacency of a large scale solar farm to our property may impair the value of our land and any potential future residential home values.
4. The solar panels proposed are rated for wind speeds up to 175 mph. Guam has experienced typhoons in most recent history with sustained winds higher than that design specification. This could present hazardous conditions for any residents and farming communities located in the valley.
5. The solar farm developer, who plans to utilize a very large tract of land in the area has not presented any plans to improve the Water, Sewage and Communication infrastructure throughout the valley for the benefit of neighboring landowners.
6. The Sasaiyan valley is a peaceful, serene oceanfront environment that should have as its highest and best use, residential communities, farming and other low impact uses.

For these reasons, we urge the Land Use Commission to seek other large tracts of land for its alternative energy initiatives.

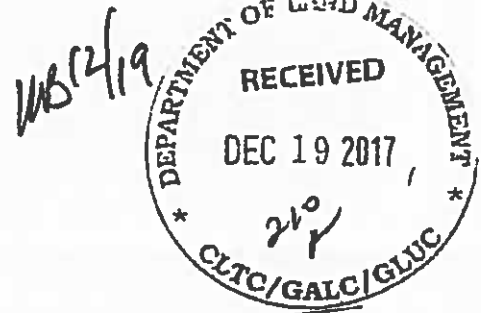
Sincerely,


Joseph F. Camacho
Administrator, Estate of Irene W. Camacho

cc/12/16
12/16

December 13, 2017

Mr. John Arroyo
Chairman, Guam Land Use Commission
c/o Department of Land Management
P.O. Box 2950
Hagatna, Guam 96932



Re: Application No 2017-39 for a Solar Farm Development in the Sasajyan Valley

Dear Mr. Arroyo:

As the owner of Lot No 5354-3A-6-R1-8 and Lot No 5354-3A-6-R1-10, I respectfully submit the following testimony relating to the Solar Farm development in the Sasajyan area.

While I support the Intent to develop sustainable alternative energy solutions for Guam, I am opposed to this development in "our" valley for the following reasons:

1. The Eduardo and Irene Camacho family owns 105,560 square meters or 26.39 acres and has medium to long range goals to develop our properties as a residential community.
2. Our property is situated immediately adjacent to the proposed development site.
3. The adjacency of a large scale solar farm to our property may impair the value of our land and any potential future residential home values.
4. The solar panels proposed are rated for wind speeds up to 175 mph. Guam has experienced typhoons in most recent history with sustained winds higher than that design specification. This could present hazardous conditions for any residents and farming communities located in the valley.
5. The solar farm developer, who plans to utilize a very large tract of land in the area has not presented any plans to improve the Water, Sewage and Communication infrastructure throughout the valley for the benefit of neighboring landowners.
6. The Sasajyan valley is a peaceful, serene oceanfront environment that should have as its highest and best use, residential communities, farming and other low impact uses.

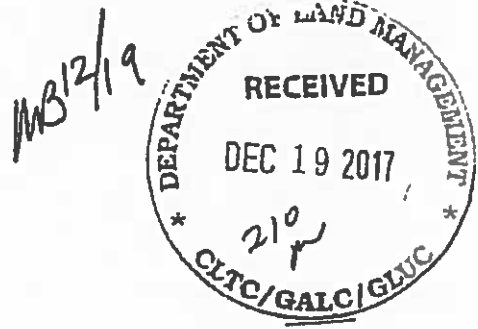
For these reasons, we urge the Land Use Commission to seek other large tracts of land for its alternative energy initiatives.

Sincerely,

Joseph F. Camacho
Landowner

December 13, 2017

Mr. John Arroyo
Chairman, Guam Land Use Commission
c/o Department of Land Management
P.O. Box 2950
Hagatna, Guam 96932



Re: Application No 2017-39 for a Solar Farm Development in the Sasajyan Valley

Dear Mr. Arroyo:


As the owner of Lot No 5354-3A-6-R1-12, I respectfully submit the following testimony relating to the proposed Solar Farm development in the Sasajyan area.

While I support the intent to develop sustainable alternative energy solutions for Guam, I am opposed to this proposed development in our valley for the following reasons:

1. The Eduardo and Irene Camacho family owns 105,560 square meters (approximately 26.39 acres, and has medium to long-range goals to develop our properties as a residential community.
2. Our properties are situated immediately adjacent to the proposed development site.
3. The adjacency of a large scale solar farm next to our property may impair the value of our land and any potential future residential home values.
4. The solar panels proposed are rated for winds up to 175 mph. Guam has experienced typhoons in most recent history with sustained winds higher than that design specification. This could present hazardous conditions for any residents and farming communities located in the valley.
5. The solar farm developer, who plans to utilize a very large tract of land in the area has not presented any plans to improve the Water, Sewage and Communication infrastructure throughout the valley for the benefit of neighboring landowners.
6. The Sasajyan valley is a peaceful, serene oceanfront environment that should have as its highest and best use, residential communities, farming and other low impact uses.

For these reasons, we urge the Land Use Commission to seek other large tracts of land for its alternative energy initiatives.

Sincerely,


Eduardo G. Camacho
Landowner

12/19
cert

PUBLIC NOTICE

*Noted
Via email
1/2/18
CND*

AN APPLICATION HAS BEEN FILED WITH THE GUAM LAND USE COMMISSION (GLUC) FOR A CONDITIONAL USE PERMIT

APPLICATION DESCRIPTION: MANGILAO SOLAR PLANT

OWNER/DEVELOPER: KEPKO & LG CNS

LOT, TRACT, MUNICIPALITY: LOT 1, TRACT 1541, MANGILAO

PROPOSED CONDITIONAL USE: 60 MW SOLAR PV FACILITY

DATE:

NOV. 7, 2017

TIME:

6:00 PM

PLACE:

MANGILAO COMMUNITY CENTER

PUBLIC HEARING:

JANUARY 11, 2018

1:30 PM

ALL CONFERENCE ROOM 2ND FLOOR, 172 BUILDING, MANGILAO COMMUNITY CENTER

APPLICATION NO: 2017-39

APPLICATION FOR CONDITIONAL USE

MANGILAO SOLAR PLANT PHOTOVOLTAIC FACILITY

LOT 1, TRACT 1541, SASAYJAN
MUNICIPALITY OF MANGILAO, GUAM

**ADDITIONAL RESPONSES
WITH ATTACHMENT**
SUPPLEMENT # 3

05 JANUARY 2018

PREPARED BY:

TG ENGINEERS, PC

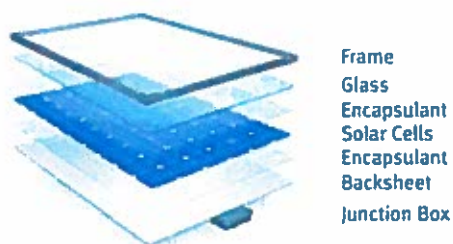
Additional responses for GLUC

1. KEPCO and LG CNS concurs with all Staff Report recommendations for approval with conditions below:

- Developers must meet ARC Conditions
- Project must obtain a Building Permit within 1-year
- Building Permit schedule shall not be extended
- Any Site Plan revisions shall be processed with an updated Site Plan submitted to the GLUC at completion.

2. Mayor Mantanane expressed health concerns from panel materials, and whether panels are safe for environment?

According to 'Test of Hygienic safety standards of water-based materials' which tested several physical and chemical materials eluded from modules, the result shows that modules are safe from any toxic material. There are lists of chemical materials that KOREA TESTING & RESEARCH INSTITUTE (KTR) sets. The result is divided by 'Not Present' items and 'Present' item. 'Not Present' means there are none of the chemical materials from modules, so literally '0' chemical materials for most test items. And other items are also below the standard level satisfying the test criteria.



KTR test of PV module did not detect any heavy metal materials as a result of water elusion test conducted by KTR, and it shows all test items satisfy the standard. Also, LG CNS constructed float solar plant on the reservoir, and all materials are proved to be harmless to the environment.

As for solar modules, as shown in the figure on the left, the solar cells which contain silicon are encapsulated and protected by several layers. The LG module is designed to hold up to 5400Pa using tempered glass, which can withstand weight of 550kg / m². So there are fewer probabilities that modules are completely broken.

In the case of other projects built by LG CNS, modules were not completely broken. Mostly, the frame or glass was slightly cracked, but modules are mounted on the fixed structure, so no materials in module was released from inside.

Silicon, which is the main material of solar cell, is well known material which is used for every semi-conductor product, such Television, Computer and Cellphone

In terms of PV component ratio, glass takes 74% of mass which is the highest. The aluminum frame amounts to 10% whereas all polymers add to approximately 6.5%. In contrast, the mass of solar cells is 3% and all other materials (like copper) contribute less than 1%. Therefore, there will be mostly physical debris-mostly glass- when modules happen to be broken.

3. What happens at the end of the 25-years Power Purchase Agreement (PPA)? At end of 25-years GPA may decommission or may extend the PPA for KEPCO – LG operations?

KEPCO-LG CNS may extend PPA up to 5 years or decommission the Solar Plant. If KEPCO-LG CNS plans to demolish the plant after 25 years of operation, modules shall be disposed of on Guam, according to the approved standard and criteria after 25 years. Structures will be removed and recycled. Batteries will be collected back to Korea, and the structure will be removed and recycled.

4. Commissioner Tae Oh inquired about panel materials, and whether any toxic chemicals will result?

Please refer to answer #2.

5. Mayor Mantanane – asked will there be any contamination under panels after 25-years?

Please refer to answer #2.

6. USFWS – office getting contacted to review reports. Requesting a copy of reports and who completed the investigations and credentials? Reports must consider overall area and not just focused on the property.

Public Responses filed with the DLM have been provided to the USFWS.

Furthermore, the USFWS also wanted TGE to provide an evaluation of potential for impacts to the two (2) federally endangered butterflies resulting from the proposed construction of solar energy facility at Marbo and credentials and or references used in its Biological Surveys. A summary of TGE response to the issue above is as follows:

Mariana wandering butterfly (*Vagrans egistina*)

| | |
|---|-----------------------------------|
| Host Plant: | Native <i>Maytenus thompsonii</i> |
| Host Plant habitat: | Primary and secondary forest |
| Number of host plants recorded: | Four (4) |
| Number of <i>Vagrans egistina</i> recorded: | None |

Summary of Anticipated Impacts

Vagrans egistina has not been recorded on Guam since 1979 (USFWS Undated). No adult specimens, eggs, larvae or pupae were observed during surveys of the subject site. Host plants were recorded in four locations. Host plants are considered fairly common, therefore it is thought that this butterfly species has disappeared for reasons unrelated to host plant availability (Lindstrom and Benedict 2014). Given this butterfly has not been recorded for 38 years and is considered extirpated on Guam, the proposed project will have no direct or indirect impact upon *Vagrans egistina*.

Mariana eight-spot butterfly (*Hypolimnys octocula marianensis*)

| | |
|--|--|
| Host Plants: | Natives <i>Procris pedunculata</i> , <i>Elatostema calcareum</i> |
| Moist primary limestone forest featuring high relief karst | |
| Number of host plants recorded: | None |
| Number of <i>H. octocula marianensis</i> recorded: | None |

Summary of Anticipated Impacts

No *Hypolimnys octocula marianensis* eggs, larvae, pupae or adults were observed during surveys of the subject site. No host plants were recorded. The specialized habitat where the two host plants are most commonly found, moist primary forest with steep and rugged karst features inaccessible to ungulates (Lindstrom and Benedict 2014), was not encountered on survey transects. The butterfly was purportedly recorded on a neighboring property across the main access road from the subject site. While the date and exact location of this sighting is not known at this time, areas fitting this description would likely be closer to the toe of the cliff line to the north and east where more rugged limestone habitat occurs.

The abundance of ungulates present together with historical human disturbances to include clearing, grading (US military, SOHBU Resort and recent housing developer), burning and farming/ranching documented in a Phase I Environmental Site Assessment by ARC Environmental Services (2017) completed for the project, may have altered conditions resulting in the absence of host plants and habitat that might have been present historically. The documented close association between *H. octocula marianensis*, its host plants and the limited specialized habitat that they are found within, is known to be a vulnerability affecting their survival and a key conservation consideration (Shreiner and Nafus 1997).

While little is known about the two (2) host plants abundance island wide, they are considered to be uncommon in their range and vulnerable to ungulate grazing (USFWS 2013). Given the absence of host plants and specialized karst forest habitat within the project footprint, and the availability of undisturbed, suitable habitat along the surrounding embayment and coastline, it is anticipated that the proposed project to construct a solar energy facility will have no significant direct or indirect impacts upon *H. octocula marianensis*.

References

- ARC Environmental Services. Phase I Environmental Site Assessment Lot No. 1 TRACT 1541 Mangilao. Final Report 2017.
- Lindstrom, D. P. and J. C. Benedict. 2014. Final Project Report Federal Candidate Species Surveys on Guam. College of Natural and Applied Sciences, University of Guam Mangilao.
- Shreiner, I. and D. Nafus. 1997. Butterflies of Micronesia. Agricultural Experiment Station, College of Agriculture and Life Sciences, University of Guam Mangilao.
- USFWS. 2013. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form.
- USFWS. Undated. Final Mariana Wandering Butterfly Poster.
- Responses to questions raised in GLUC hearing for Marbo Solar Facility

1. Entity who completed field biological survey and report.

ARC Environmental Services Inc. team performed all field survey activities at the project site. We have completed numerous natural resource surveys across the island for private and local government projects as well as for various US Navy facilities. A team of three (3) was utilized to include biologists with recent relevant experience performing Endangered Species Act (ESA) listed plant and wildlife species surveys at the proposed Marine cantonment site in northern Guam and assisting with ongoing research on skink populations on Cocos Island.

2. Focus on overall area not just project site.

The subject property encompasses approximately 220 acres portions of which will be avoided for natural and historic resource issues. Early on, the project footprint was shifted

to avoid the Marbo Cave area where higher quality habitat is present. The proposed footprint also avoids the coastal bench area where historic resource issues may remain and a forest area along the access road on the northern edge of the property, across from which a federally endangered snail *Samoana fragilis* colony and possibly a federally endangered Mariana eight-spot butterfly (*Hypolimnas octocula marianensis*) chrysalis have purportedly been observed. None of the three (3) ESA listed tree snails were recorded during field surveys of the subject property.

3. Absence of federally endangered Mariana wandering butterfly (*Vagrans egistina*) despite presence of host plant lulu hut (*Maytenus thompsonii*).

While the host plant is still fairly common on Guam, the Mariana wandering butterfly has not been observed in recent times and is considered extinct. A more detailed discussion of the two (2) federally listed butterflies and their host plant presence has previously been submitted to the GLUC and can be referred to.

4. Project impacts upon birds.

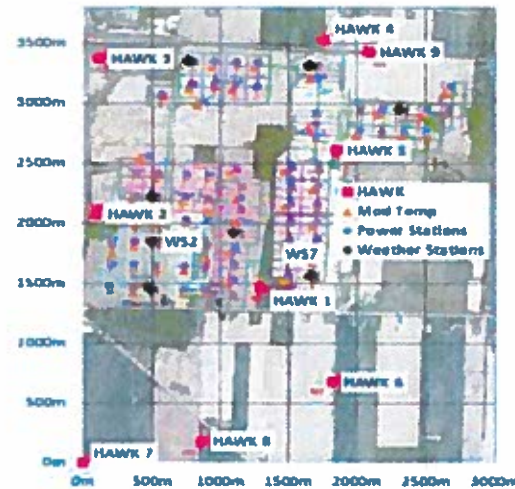
The development of the proposed solar facility will require removal of approximately 175 acres of disturbed secondary forest and mixed grass/shrub communities. Six (6) bird species were recorded during stationary and pedestrian surveys focused on early morning hours. They were observed flying over, landing and foraging in various areas on site. None of these species are protected under the ESA or are migratory in nature. All but one, the native Yellow bittern (*Ixobrychus sinensis*), are introduced species. The development of the site will reduce habitat for birds in the Marbo area and likely change the mix of birds utilizing the site since some species forage on maintained shoulders, buffers, and other landscaped areas that will be established post construction. Given the availability of very substantial high quality undeveloped areas in the Sasayan embayment and extended eastern coastline of Guam and the possibility of continued use of portions of the site during operations, impacts to birds overall are anticipated to be insignificant.

5. Project consequences relative to any resulting increases in ambient temperatures and effects upon reported *Samoana fragilis* snail colony and possible Mariana eight-spot butterflies across the access road north of the site near the old quarry will be lessened by:
 - a. Windward conditions – predominant north-easterly trade winds and perhaps of turbulent flow will be present for most of the year.
 - b. Vegetation Buffers (strip of steep forested area to remain) and general buffers around the perimeter of the site and arrays will be maintained.
 - c. The lower cliff bench will also be preserved with no construction activity allowed.
 - d. The project site topography is not a depression for higher temperatures to persist.
 - e. The tilt angle of panels for the site will be in the North-South attitude which points away from the strip of steep forested area and toward the Pacific Ocean.
6. Additionally, to address any concerns regarding temperature effects from the solar project on neighboring properties, TGE has provided a technical study entitled "Analysis of the Potential for a Heat Island Effect in Large Solar Farms" (the complete reference study is attached). TGE has provided as summary of the technical analysis, field simulation results, and conclusions as follows:

[Analysis of the Potential for a Heat Island Effect in Large Solar Farms]

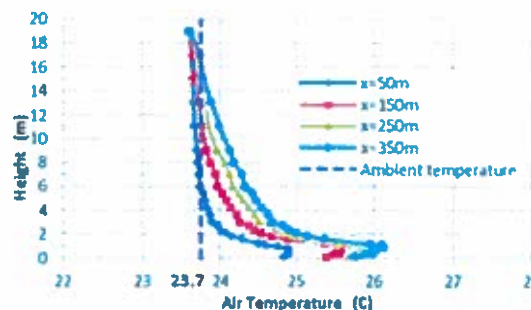
1. FIELD DATA DESCRIPTION AND ANALYSIS

- Detailed measurements of temperature, wind speed, wind direction, solar irradiance, relative humidity, and rain fall were recorded at a large solar farm in North America. Fig. 1 shows an aerial photograph of the solar farm and the locations where the field measurements are taken.

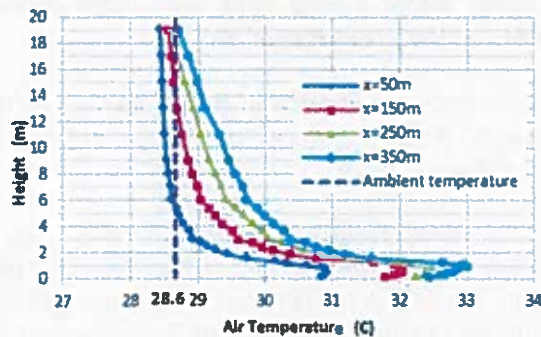


[Fig. 1. A picture of the solar farm indicating the locations of the monitoring stations]

- Figures 2a and 2b show the air temperature as a function of height at different downwind distances in the morning and afternoon during a sunny summer day. At 9 am (irradiance 500 W/m², wind speed 1.6 m/s, inlet ambient temperature 23.7), the heat from the solar array is dissipated at heights of 5-15m, whereas at 2 pm (irradiance 966 W/m², wind speed 2.8m/s, inlet ambient temperature 28.6 °C), the temperature of the panels has reached the daily peak, and the thermal energy takes up to 18 m to dissipate.



[Fig. 2a. 9:00 am]



[Fig. 2b. 2:00 pm]

2. CONCLUSION

- a. The field data and our simulations show that the annual average of air temperatures at 2.5 m of the ground in the center of simulated solar farm section is 1.9°C higher than the ambient and that it declines to the ambient temperature at 5 to 18 m heights. The field data also show a clear decline of air temperatures as a function of distance from the perimeter of the solar farm, with the temperatures approaching the ambient temperature (within 0.3°C), at about 300 m away. Analysis of 18 months of detailed data showed that in most days, the solar array was completely cooled at night, and, thus, it is unlikely that a heat island effect could occur.
- b. Our simulations also show that the access roads between solar fields allow for substantial cooling, and therefore, increase of the size of the solar farm may not affect the temperature of the surroundings. Simulations of large (e.g., 1 million m²) solar fields are needed to test this hypothesis.

References

- D. Turney and V. Fthenakis Environmental, "Impacts from the installation and operation of large-scale solar power plants," *Renewable and Sustainable Energy Reviews*, vol. 15, pp. 3261-3270, 2011.
- F.G. Nemet, "Net radiative forcing from widespread deployment of photovoltaics," *Environ. Sci. Technol.*, vol. 43, pp. 2173-2178, 2009.
- M. Donovan, "Memorandum: impact of PV systems on local temperature," SunPower, July 6, 2010. http://www.rurdev.usda.gov/SupportDocuments/EA_5_17_13_RUS_PartA.pdf.
- Y. Genchi, M. Ishisaki, Y. Ohashi, H. Takahashi, & A. Inaba, "Impacts of large-scale photovoltaic panel installation on the heat island effect in Tokyo," in *Fifth Conference on the Urban Climate*, 2003.
- Vasilis Fthenakis and Yuanhao Yu, "Analysis of the Potential for a Heat Island Effect in Large Solar," Center for Life Cycle Analysis, Department of Earth and Environmental Engineering, Columbia University, New York, NY and PV Environmental Research Center, Brookhaven National Laboratory, Upton, NY, IEEE 39th, 2013

7. Host plants were found but no butterflies. Problem may be missing butterflies but in the area at other times.

Please refer to response to concerns by USFWS in #6 above.

8. What is known about water-based and non-water-based contaminants? Are they both present in the panel – equipment materials?

Materials eluded from module by water are explained in 'Test of Hygienic safety standards of water-based materials'. And non-water-based materials are basically PV panel materials and structures (steel, aluminum), glass, and concrete.

As for solar module, described in #3 above, the solar cells, which contain silicon are encapsulated and protected by several layers—please refer to illustration in #3. The LG PV module is designed to hold up to 5400Pa using tempered glass, which can withstand weight of 550kg / m2. So there are less probabilities that modules are completely broken.

9. Robert Unpingco is in favor of the project and requested for power and water to be provided to his lot.

In the case of water and power supply for neighbors, it is the duty of the GWA and GPA. Nevertheless, if neighbors really want water supply and power supply, we can consider the best ways for cooperation with the community.

10. Concerned about typhoon debris.

TGE has responded the PV solar facility is designed to current building codes and standards. These codes specify 170 mph wind speed and zone 4 earthquake requirements. However, LG CNS has increased the wind speed design criteria to meet 176 mph for this project. It may be envisioned that test-piles may be installed to determine the true strength of the PV structure under extreme typhoon conditions as a form of mitigation. Additionally, the design of the PV module rack structure is such that it is quite low to ground.

In the case of other projects built by LG CNS, modules were not completely broken. Mostly, the frame or glass was slightly cracked, but modules are mounted on the fixed structure, so no materials in module was leaked from inside.

Silicon, which is the main material of solar cell, is well known material which is used for every semi-conductor product.

In terms of PV component ratio, glass takes 74% of mass which is the highest. The aluminum frame amounts to 10% whereas all polymers add to approximately 6.5%. In contrast, the mass of solar cells is 3% and all other materials (like copper) contribute less than 1%. Therefore, there will be mostly physical debris-mostly glass- when modules happen to be broken.

11. Marcel Camacho noted his concerns for future safety against contamination on his adjacent property.

There will be no chemical contaminations to adjacent property. And for water and soil, KEPCO-LG CNS is carefully designing storm water management and drainage plans, and erosion control plans to avoid any impact to adjacent property in accordance with all building codes and regulatory requirements.

End of meeting.

ATTACHMENT

Analysis of the Potential for a Heat Island Effect in Large Solar Farms

Vasilis Fthenakis^{1,2} and Yuanhao Yu¹

¹Center for Life Cycle Analysis, Department of Earth and Environmental Engineering, Columbia University, New York, NY

²PV Environmental Research Center, Brookhaven National Laboratory, Upton, NY

Abstract — Large-scale solar power plants are being built at a rapid rate, and are setting up to use hundreds of thousands of acres of land surface. The thermal energy flows to the environment related to the operation of such facilities have not, so far, been addressed comprehensively. We are developing rigorous computational fluid dynamics (CFD) simulation capabilities for modeling the air velocity, turbulence, and energy flow fields induced by large solar PV farms to answer questions pertaining to potential impacts of solar farms on local microclimate. Using the CFD codes Ansys CFX and Fluent, we conducted detailed 3-D simulations of a 1 MW section of a solar farm in North America and compared the results with recorded wind and temperature field data from the whole solar farm. Both the field data and the simulations show that the annual average of air temperatures in the center of PV field can reach up to 1.9°C above the ambient temperature, and that this thermal energy completely dissipates to the environment at heights of 5 to 18 m. The data also show a prompt dissipation of thermal energy with distance from the solar farm, with the air temperatures approaching (within 0.3°C) the ambient at about 300 m away of the perimeter of the solar farm. Analysis of 18 months of detailed data showed that in most days, the solar array was completely cooled at night, and, thus, it is unlikely that a heat island effect could occur. Work is in progress to approximate the flow fields in the solar farm with 2-D simulations and detail the temperature and wind profiles of the whole utility scale PV plant and the surrounding region. The results from these simulations can be extrapolated to assess potential local impacts from a number of solar farms reflecting various scenarios of large PV penetration into regional and global grids.

Index Terms — PV, climate change, heat island, fluid dynamics

I. INTRODUCTION

Solar farms in the capacity range of 50MW to 500 MW are being proliferating in North America and other parts of the world and those occupy land in the range from 275 to 4000 acres. The environmental impacts from the installation and operation phases of large solar farms deserve comprehensive research and understanding. Turney and Fthenakis [1] investigated 32 categories of impacts from the life-stages of solar farms and were able to categorize such impacts as either beneficial or neutral, with the exception of the “local climate” effects for which they concluded that research and observation are needed. PV panels convert most of the incident solar radiation into heat and can alter the air-flow and temperature profiles near the panels. Such changes, may subsequently affect the thermal environment of near-by populations of humans and other species. Nemet [2] investigated the effect on

global climate due to albedo change from widespread installation of solar panels and found this to be small compared to benefits from the reduction in greenhouse gas emissions. However, Nemet did not consider local microclimates and his analytical results have not been verified with any field data. Donovan [3] assumed that the albedo of ground-mounted PV panels is similar to that of underlying grassland and, using simple calculations, postulated that the heat island effect from installing PV on grassy land would be negligible. Yutaka [4] investigated the potential for large scale of roof-top PV installations in Tokyo to alter the heat island effect of the city and found this to be negligible if PV systems are installed on black roofs.

In our study we aim in comprehensively addressing the issue by modeling the air and energy flows around a solar farm and comparing those with measured wind and temperature data.

II. FIELD DATA DESCRIPTION AND ANALYSIS

Detailed measurements of temperature, wind speed, wind direction, solar irradiance, relative humidity, and rain fall were recorded at a large solar farm in North America. Fig. 1 shows an aerial photograph of the solar farm and the locations where the field measurements are taken.

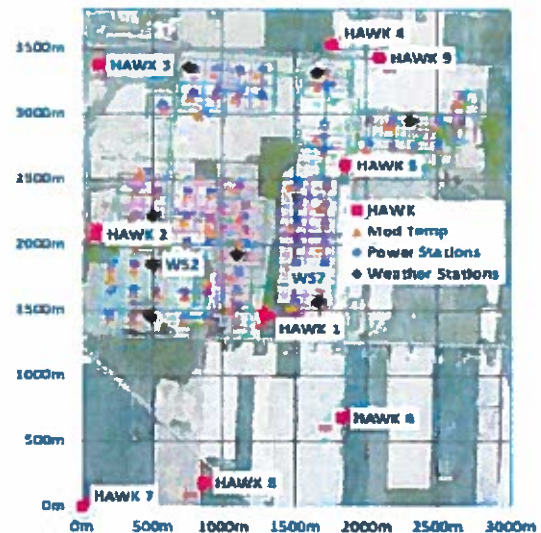


Fig. 1. A picture of the solar farm indicating the locations of the monitoring stations

The field data are obtained from 17 monitoring stations within and around the solar farm, including 8 weather stations (WS) and 9 Hawk stations (HK), all at 2.5 m heights off the ground. There also 80 module temperature (MT) sensors at the back-side of the modules close to each of the corresponding power stations. The WS and MT provide data at 1-min intervals, while the Hawk provides data every 30 minutes. The WS and MT data cover a period of one year from October 2010 to September 2011, while the Hawk data cover a period of 18 months from March 2010 through August 2011.

Hawk stations 3, 6, 7, 8 and 9 are outside the solar farm and were used as reference points indicating ambient conditions. The measurements from Hawk 3, 6, 8 and 9 agree very well confirming that their distances from the perimeter of the solar farm are sufficient for them to be unaffected by the thermal mass of the PV system; Hawk 7 shows higher temperatures likely due to a calibration inaccuracy. In our comparative data analysis we use Hawk 6 as a reference point and, since the prevailing winds are from the south, we selected the section around WS7 as the field for our CFD simulations. Figures 2 to 7 show the difference between the temperatures in Hawk 6 and those in the weather stations WS2 and WS7 within the field, and Hawks 1, 2, 4 and 5 around the solar field.

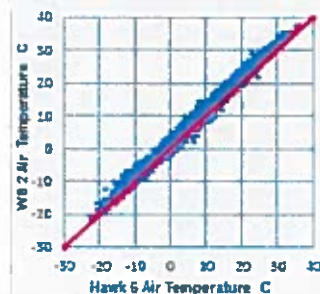


Fig. 2. Air temp WS2 vs. Hawk 6

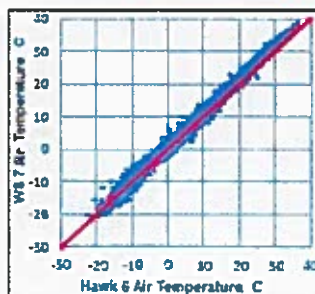


Fig. 3. Air temp WS7 vs. Hawk6

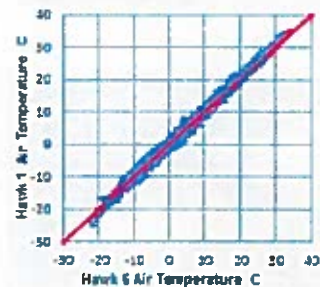


Fig. 4. Air temp Hawk 1 vs. 6

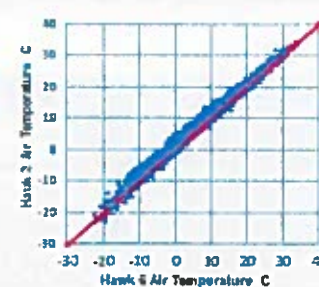


Fig. 5. Air temp Hawk 2 vs. 6

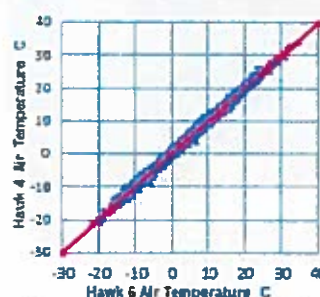


Fig. 6. Air temp Hawk 4 vs. 6

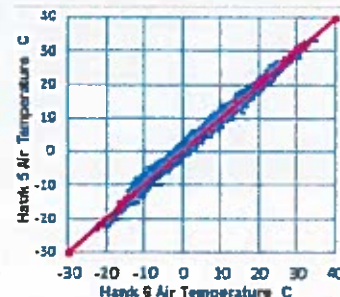


Fig. 7. Air temp Hawk 5 vs. 6

These figures and Table 1 show that with the exception of Hawk 4, the closer the proximity to solar farm the higher the temperature difference from the ambient (indicated by Hawk 6). The relative high temperatures recorded at Hawk 4, and also the relative low temperatures at Hawks 1 and 5 are explained by the prevailing wind direction, which for the time period used in our analysis (8/14/2010-3/14/2011) was Southerly (158°-202°). Hawk 4 is downwind of the solar farm, whereas Hawks 1 and 5 are upwind; the downwind station "feels" more the effect of the heat generated at the solar farm than the ones upwind.

Fig. 8 shows the decline in air temperature as a function of distance to solar farm perimeter. Distances for WS2 and WS7 are negative since they are located inside the solar farm site. WS2 is further into the solar farm and this is reflected in its higher temperature difference than WS7.

TABLE I
DIFFERENCE OF AIR TEMPERATURE (@ 2.5 M HEIGHTS) BETWEEN THE LISTED WEATHER AND HAWK STATIONS AND THE AMBIENT

| Met Station | WS2 | WS7 | HK1 | HK2 | HK3 | HK4 | HK5 | HK9 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Temp Difference from H6 (°C) | 1.878 | 1.468 | 0.488 | 1.292 | 0.292 | 0.609 | 0.664 | 0.289 |
| Distance to solar farm perimeter (m) | -440 | -100 | 100 | 10 | 450 | 210 | 20 | 300 |

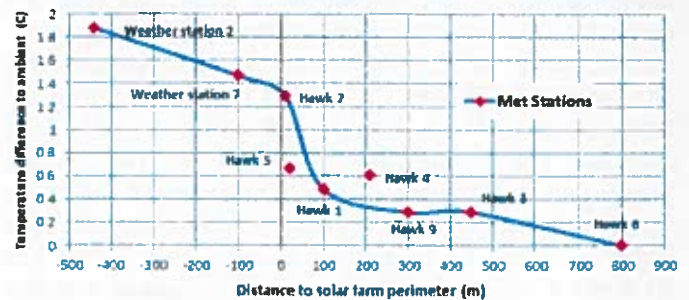


Fig. 8. Air temperature difference as a function of distance from the perimeter of the solar farm. Negative distances indicate locations within the solar farm.

We also examined in detail the temperature differences between the modules and the surrounding air. These vary throughout the year but the module temperatures are consistently higher than those of the surrounding air during the day, whereas at night the modules cool to temperatures below ambient; an example is shown in Fig. 9. Thus, this PV solar farm did not induce a day-after-day increase in ambient temperature, and therefore, adverse micro-climate changes from a potential PV plant are not a concern.

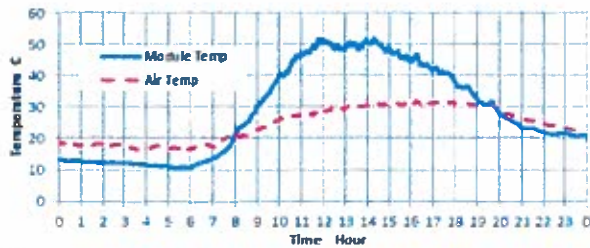


Fig. 9. Comparison of module temperature and air temperature 2.5 m off the ground on a sunny day (July 1, 2011)

III. CFD MODEL DEVELOPMENT

In preliminary simulations we tested the Ansys CFX and FLUENT computational fluid dynamics codes (CFD) and decided to use FLUENT in detailed simulations. FLUENT offers several turbulence schemes including multiple variations of the $k-\epsilon$ models, as well as $k-\omega$ models, and Reynolds stress turbulence models. We used the standard, renormalized-group (RNG), and realizable $k-\epsilon$ turbulence closure scheme as it is the most commonly used model in street canyon flow and thermal stratification studies [5]. FLUENT incorporates the P-1 radiation model which affords detailed radiation transfer between the solar arrays, the ground and the ambient air; it also incorporates standard free convection and wind-forced convection models. Our choice of solver was the pressure-based algorithm SIMPLE which uses a relationship between velocity and pressure corrections to enforce mass conservation and obtain the pressure field. We conducted both three-dimensional (3-D) and 2-D simulations.

A 3-D model was built of four fields each covering an area of 93-meters by 73-meters (Fig. 10). Each field contains 23 linear arrays of 73-meter length and 1.8-meter width. Each array has 180 modules of 10.5% rated efficiency, placed facing south at a 25-degree angle from horizontal, with their bottom raised 0.5 m from the ground and their top reaching a height of 1.3 m. Each array was modeled as a single 73 m \times 1.8 m \times 1 cm rectangular. The arrays are spaced 4 meters apart and the roads between the fields are 8 m. Fig. 10 shows the simulated temperatures on the arrays at 14:00 pm on 7/1/2011, when the irradiance was 966 W/m². As shown, the highest average temperatures occur on the last array (array 46). Temperature on the front edge (array 1) is lower than in the center (array 23). Also, temperature on array 24 is lower than array 23, which is apparently caused by the cooling induced by the road space between two fields, and the magnitude of the temperature difference between arrays 24 and 46 is lower than that between arrays 1 and 23, as higher temperature differences from the ambient, result in more efficient cooling.

TABLE II
MODULES TEMPERATURE

| Arrays | 1 | 23 | 24 | 46 |
|----------------|------|------|------|------|
| Temperature °C | 46.1 | 56.4 | 53.1 | 57.8 |

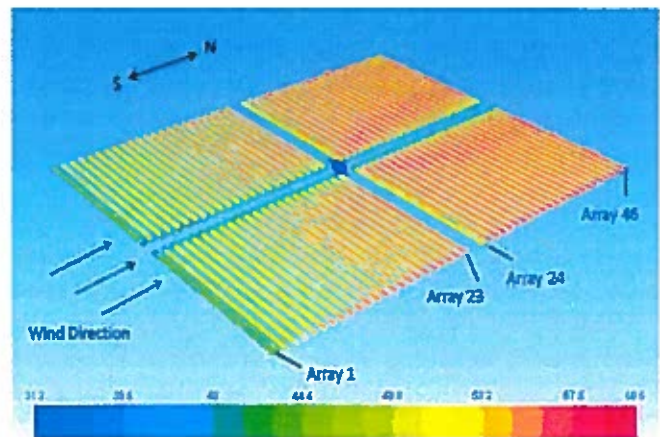
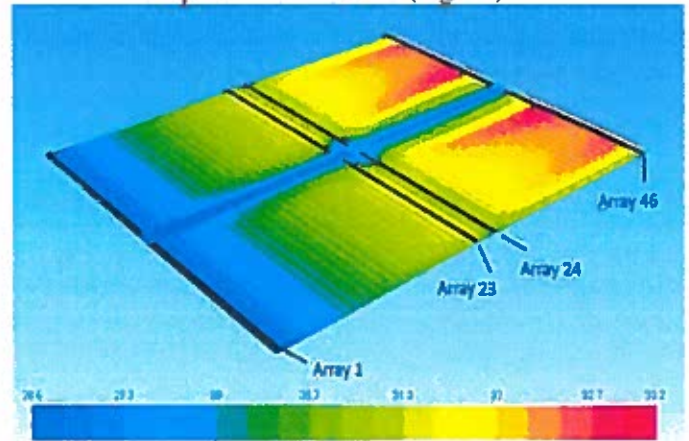
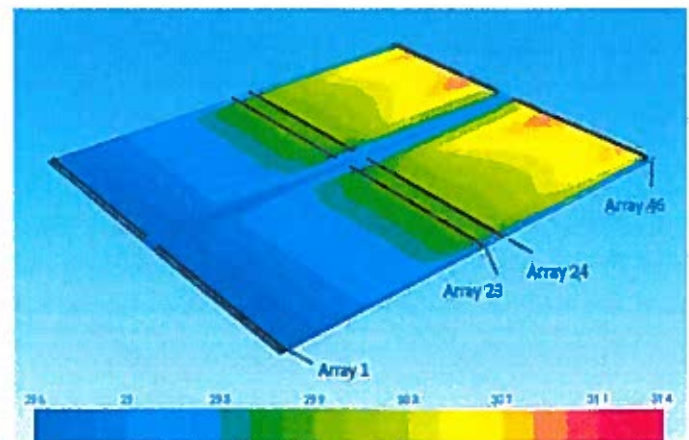


Fig. 10. Module temperatures from 3-D simulations of air flows and thermal exchange during a sunny day

Our simulations also showed that the air temperatures above the arrays at a height of 2.5 m ranged from 28.6 °C to 31.1 °C; the ambient temperature was 28.6 °C (Fig. 11).



(a)



(b)

Fig. 11 Air temperatures from 3-D simulations during a sunny day. a) Air temperatures at a height of 1.5 m; b) air temperatures at a height of 2.5 m.

TABLE III
AIR TEMPERATURE

| Temperature | Ambient (°C) | Low (°C) | High (°C) | Average (°C) |
|-------------|--------------|----------|-----------|--------------|
| 2.5m height | 28.6 | 28.6 | 31.1 | 30.1 |
| 1.5m height | 28.6 | 28.6 | 33.2 | 30.8 |

These simulations show a profound cooling effect with increasing height from the ground. It is shown that the temperatures on the back surface of solar panels is up to 30° C warmer than the ambient temperature, but the air above the arrays is only up to 2.5°C higher than the ambient (i.e., 31.1°C). Also the road between the fields allows for cooling, which is more evident at the temperatures 1.5 m off the ground (Fig. 11a). The simulations show that heat build-up at the power station in the middle of the fields has a negligible effect on the temperature flow fields; it was estimated that a power station adds only about 0.4% to the heat generated by the corresponding modules.

The 3-D model showed that the temperature and air velocity fields within each field of the solar farm were symmetrical along the cross-wind axis; therefore a 2-D model of the downwind and the vertical dimensions was deemed to be sufficiently accurate. A 2-D model reduced the computational requirements and allowed for running simulations for several subsequent days using actual 30-min solar irradiance and wind input data. We tested the numerical results for three layers of different mesh sizes and determined that the following mesh sizes retain sufficient detail for an accurate representation of the field data: a) Top layer: 2m by 1m, b) Middle layer: 1.5m by 0.6m, c) Bottom layer: 1m by 0.4m. According to these mesh specifications, a simulation of 92 arrays (length of 388m, height 9m), required a total of 13600 cells. Figures 12-15 show comparisons of the modeled and measured module and air temperatures.

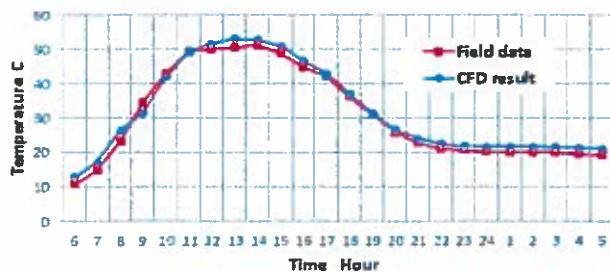


Fig. 12. Comparisons of field and modeled module temperatures: a sunny summer day (7/1/2011); 2-D simulations.

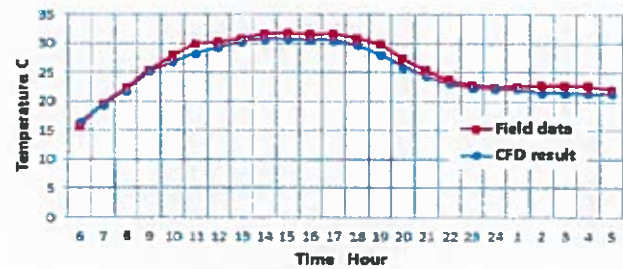


Fig. 13. Comparisons of field and modeled air temperatures at a height of 2.5 m; a sunny summer day (7/1/2011); 2-D simulations.

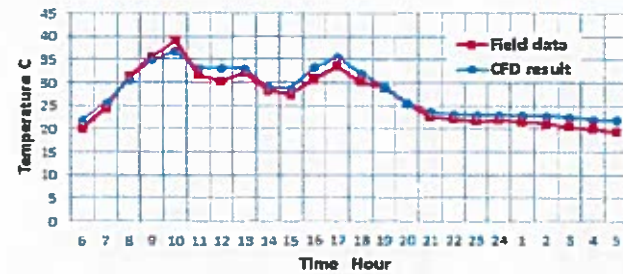


Fig. 14. Comparisons of field and modeled module temperatures: a cloudy summer day (7/11/2011); 2-D simulations.

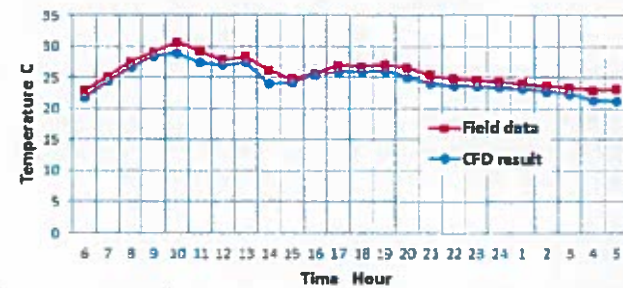
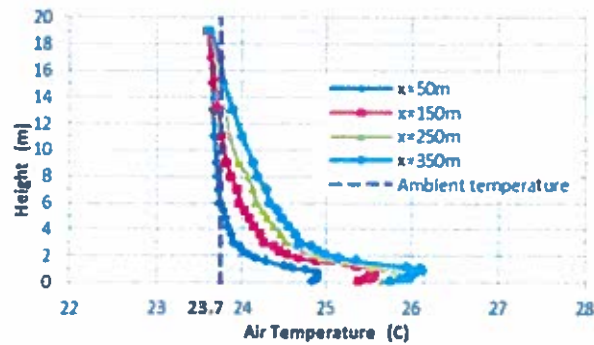
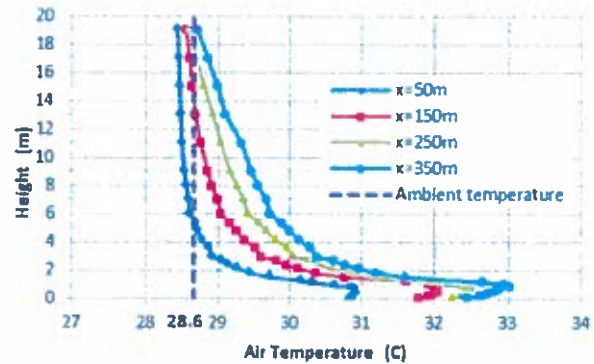


Fig. 15. Comparisons of field and modeled air temperatures at a height of 2.5 m; a cloudy summer day (7/11/2011); 2-D simulations.

Figures 16a and 16b show the air temperature as a function of height at different downwind distances in the morning and afternoon during a sunny summer day. At 9 am (irradiance 500 W/m², wind speed 1.6 m/s, inlet ambient temperature 23.7°C), the heat from the solar array is dissipated at heights of 5-15m, whereas at 2 pm (irradiance 966 W/m², wind speed 2.8m/s, inlet ambient temperature 28.6°C, the temperature of the panels has reached the daily peak, and the thermal energy takes up to 18 m to dissipate.



(a) 9:00 am



(b) 2:00 pm

Fig. 16 Air temperatures within the solar farm, as a function of height at different downwind distances. From 2-D simulations during a sunny summer day (7/1/2011) at 9 am and 2 pm.

IV. CONCLUSION

The field data and our simulations show that the annual average of air temperatures at 2.5 m of the ground in the center of simulated solar farm section is 1.9°C higher than the

ambient and that it declines to the ambient temperature at 5 to 18 m heights. The field data also show a clear decline of air temperatures as a function of distance from the perimeter of the solar farm, with the temperatures approaching the ambient temperature (within 0.3°C), at about 300 m away. Analysis of 18 months of detailed data showed that in most days, the solar array was completely cooled at night, and, thus, it is unlikely that a heat island effect could occur.

Our simulations also show that the access roads between solar fields allow for substantial cooling, and therefore, increase of the size of the solar farm may not affect the temperature of the surroundings. Simulations of large (e.g., 1 million m²) solar fields are needed to test this hypothesis.

ACKNOWLEDGEMENT

We are grateful to First Solar for providing data for this study.

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APPLICATION NO: 2017-39

APPLICATION FOR CONDITIONAL USE

MANGILAO SOLAR PLANT PHOTOVOLTAIC FACILITY

LOT 1, TRACT 1541, SASAYJAN
MUNICIPALITY OF MANGILAO, GUAM

PUBLIC HEARING REPLY & RESPONSES WITH ATTACHMENTS

01 DECEMBER 2017

PREPARED BY:

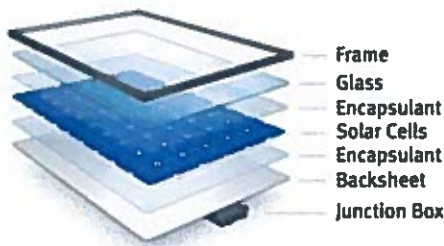
TG ENGINEERS, PC

December 1, 2017

ISSUES & COMMENTS FOR PUBLIC HEARING

Public Hearing Issues & Comments by KEPCO-LG CNS

- 1.0 Is the transmission line UG or OH?
The planned transmission interconnection line from Mangilao to Pagat Substations will be a combination of overhead and underground configurations.
- 2.0 Who will maintain the transmission line after construction?
GPA will gain title in fee simple for the new transmission interconnection line. Once they received title, GPA will be responsible for the maintenance of the line.
- 3.0 Is there silicon dust in the panels, or other toxic or hazardous materials that might leak onto the ground if panels are damaged or broken in typhoons or other scenarios?



LG Electronics module have shown any detection of any heavy metals materials as a result of water elution test conducted by KOREA TESTING & RESEARCH INSTITUTE, and it shows all test items satisfy the standard (Refer to attachment #1). Also, LG CNS constructed a floating solar plant on irrigation reservoir, and all materials are proved to be

harmless to environment.

As for the solar module, as shown in the figure on the left, the solar cells which contain silicon, are encapsulated and protected by several layers. The LG module is designed to hold up to 5400Pa using tempered glass, which can withstand weight of 550kg / m². So there is a remote probability that modules can be completely broken.

In the case of other projects built by LG CNS, modules were not completely broken. Mostly, the frame or glass was slightly cracked, but modules are mounted on the fixed structure, so no materials in module was leaked from inside.

Silicon, which is the main material of a solar cell, is already proven to be harmless to human body as it is already used in beauty/cosmetic industry and other similar applications.

- 4.0 Government has promised utility services in the past but so far broken promises. It is GPA's duty. Therefore, we think GPA should answer to neighbors.
- 5.0 Why was power infrastructure never put in place?
There are service rules for development of infrastructure and unfortunately, there were not enough customers in this area to justify building power infrastructure.
- 6.0 Who is the owner of the property? KEPCO & LG CNS Consortium.
- 7.0 Dumpsite comment caused a reaction.
KEPCO & LG CNS will clean trash dumped around the plant site and transmission line route.

- 8.0 Marcel Camacho notes he brought LG to Guam.
Marcel Camacho has worked with LG Chem, which is a subsidiary company and Battery Supplier for this project. But LG Chem is a separate company from LG CNS and there is no relationship to Marcel Camacho.
- 9.0 What is the status of the contract protest?
It is still under OPA review. We will update the information after the decision.
- 10.0 What will happen to the site at the end of the 25-year contract term? How is the contract completion regulated?
We may extend PPA up to 5 years or decommission the plant.
- 11.0 Are there any invisible negative impacts for neighbors on adjacent properties? Such as radiation or other negative health impacts from a solar farm operation?
The electricity generated by the module in a solar power plant is DC. DC (Direct current) flows without wave generation, cause no electromagnetic waves. But some devices may cause electromagnetic wave while converting DC to AC and transmitting AC current to the grid. According to the results of the research conducted by the National Institute of Radiological Research ("Measurement of exposure of electromagnetic wave generated from solar power facility"), the electromagnetic wave generated from the solar plant facilities measured is much less than electromagnetic wave protection standard-1 / 500th of the electric field 87 (V / m) and to 1/1000th of the magnetic field 62.5 (mG). Therefore the human body is barely influenced by electromagnetic waves.
It is also less than electromagnetic waves generated by most household appliances. (The notebook is 30.19V / m, 0.72mG and the fan is about 9.01V / m, 0.07mG.) With regard to negative impacts to neighboring landowners, TGE has responded it will be utilized the natural jungle and vegetation along the project perimeter to lessen the visual impacts to neighbors. TGE has planned landscaping as well to mitigate view shed natural shrubs and small trees.

What are the batteries made from and are they safe? Is it possible the batteries will explode?
Refer to Attachment #2.

- 12.0 Is it possible the batteries or panels might get damaged and leak toxic materials onto the site? Refer to Attachment #2.
- 13.0 How will the panels be disposed during operations or at the end of 25-years? Currently, LG CNS plans to demolish the power plant after 25 years of operation. Modules shall be disposed of on Guam at an approved and permitted landfill. Structures will be removed and recycled. The battery will be collected back to Korea, and the structure will be removed and recycled.
- 14.0 What are the typhoon and earthquake mitigation plans?
TGE has responded the PV solar facility is designed to current building codes and standards. These codes specify 170 mph wind speed and zone 4 earthquake requirements. However, LG CNS has increased the wind speed design criteria to meet 176 mph for this project. It may be envisioned that test-piles may be installed to determine the true strength of the PV structure under extreme typhoon conditions as a form of mitigation. Additionally, the design of the PV module rack structure is such that it is quite low to ground.

- 15.0 Do you have any information with you today that proves there are no negative health effects?
Refer to Attachment #1 and #2. And, as we answered Question #3, the main material of a solar cell, is already proven to be harmless to humans as it is already used in beauty/cosmetic field and so on.
- 16.0 What is the possibility of leakage from the batteries going into the ground? I have looked at disadvantages to solar power and there aren't a lot, but one concern is of the material that is being used (since all materials have a life span).
Refer to Attachment #1 and #2. And, Module the supplier (LG Electronics) provides a 25 year product warranty. Therefore, KEPCO-LG CNS are not aware there is a statute of limitation if contaminates are released from panels and batteries during the contract term.
- 17.0 What is the mitigation procedure for typhoons / earthquakes?
The engineering design will meet all local codes and standards—to include 176 MPH winds, and (category) 4 seismic activity—all plans, specifications and drawings will be stamped by local registered engineers. This criteria is greater than IBC 2009 adopted by the Government of Guam for building codes.
- 18.0 What will happen if there is damage to the materials? How will materials and panels be disposed of?
Any and all materials shall be properly disposed of at an approved and permitted landfill, salvage yard, or off island facility.
- 19.0 What types of chemicals comes from these materials? How do they affect the environment? Will they affect the water wells?
Refer to Attachment #1, #2 and the answer to Question #3. Therefore, KEPCO-LG CNS are not aware there is a statute of limitation if contaminates are released from panels and batteries during the contract term.
- 20.0 What is the panel material lifespan?
Module supplier (LG Electronics) provides 25 year product warranty. And we regard it as a panel lifespan.
- 21.0 What is the EPA involvement in the project?
EPA involvement in this project is to review and approval engineering designs to ensure the project, once completed, will meet all local and federal codes. And also, at # 3, # 10, and # 11, there are no possibility of chemical leaks of PV and batteries.
- 22.0 What is the statute of limitations if contamination from panels appears later?
KEPCO-LG CNS are not aware there is a statute of limitation if contaminates are released from panels during the contract term. Local and federal regulations will dictate how these cases are adjudicated in the future.
- 23.0 What is the storm water management plan?
TGE has designed a storm water plan that meets all local codes and standards. The key elements of the plan include swales, rip-rap and check-rock dams, and ponding basins to control and manage storm water onsite. These systems follow engineering best practice means and methods for implementation.

24.0 The Conditional Use approval status must meet the following.

- Health
- Welfare
- Safety

The project complies with GLUC requirements and information necessary for GLUC commissioners to make informed decisions. The general public also has been invited to review the information as part of the application process. KEPCO-LG CNS does not believe in its professional opinion Health, Welfare and Safety are in any way jeopardized.

25.0 In the GPA letter (?) it mentions Health and Welfare but not Safety?

GPA's letter was in support of this project since they are the source of this formal tender. GPA has neither expressed any negative issues to the applicant nor to the public regarding any safety issues. And, we will design and construct the solar farm in compliance with safety-related regulations.

26.0 Is there a back up plan for dealing with emergencies?

Emergency plans will have to be available in order for an occupancy permit to be approved by DPW with approvals by agencies such as the Guam Fire Department and Guam EPA. These plans will be developed as part of the Operations & Maintenance phase of the contract.

27.0 The solar facility development is not compatible with other nearby development. We believe this is one of the best choices given the history of the property and lack of development over the past three decades.

28.0 The GLUC is the final Land Use vote for the project approval.

Under current DLM rules and regulations, GLUC has the authority to render a final decision regarding the Conditional Use Permit.

29.0 If Kin had family property at Sasajyan would he still be in favor of the project?

Kin Flores clearly declined to comment because his role as Project Director for the applicant.

30.0 The Perez Grandmother sold the property for a golf course development.

Past agreements regarding the use of land were neither known to TGE/KEPCO-LG CNS nor are they an obligation for future owners to be obliged to honor. KEPCO-LG CNS has procured this project site from the latest landowner without any covenant agreements that TGE is aware of.

31.0 A solar (Industrial) facility is not the best use of the property; it should be for tourism development.





TGE has confirmed the current property is zoned Agricultural which is not designated for high density or hotel zones typical to a tourist district. As current owners of the property, KEPCO-LG CNS has decided the best and right use for the site is for the implementation of a solar facility. KEPCO-LG CNS does not consider this as an industrial utility facility but more a passive site with minimum impact to traffic, utilities, noise and or any air or water emissions.



32.0 What are the solar panel effects on birds?

KEPCO has started operating a solar farm adjacent to an airport in Hokkaido, Japan. To date, there are no issues related to airplanes as well as birds. And, TGE has conducted Biological Surveys on site and has determined no listed plants or animal species will be impacted. It is unclear what will be the indirect impact to birds once the site is cleared. TGE team biologist believes there is much better habitat from the current project site for which birds will continue to forage and proliferate.

33.0 Are other solar projects by LG close to residential neighborhoods?

LG have several references of PV plants constructed near residential areas. In 'Solar land' project, modules are installed above market buildings. In 'Skovelevo solar plant' project, there are large residential areas about 1km from the plant. Other projects such as Yeosu EXPO plant, Incheon North port solar plant are also successfully constructed in residential area. And we have constructed also several floating solar plants in an irrigation reservoir and on a small island, indicating solar plants are environmental-friendly.

| | Project Description | Place | Photo |
|---|---|--------------------------------|---|
| 1 | <ul style="list-style-type: none"> - Project Name: Solar land - Capacity: 2.5MW - Completion Date: 2014/05/09 - Type: Rooftop | Residential area, Korea |  |
| 2 | <ul style="list-style-type: none"> - Project Name: Skovelevo solar plant - Capacity: 5MW - Completion Date: 2012/06/30 - Type: Ground fixed | Residential area, Bulgaria |  |
| 3 | <ul style="list-style-type: none"> - Project Name: Yeosu EXPO plant - Capacity: 2.5MW - Completion Date: 2012/04/10 - Type: Ground fixed | Residential & Port area, Korea |  |
| 4 | <ul style="list-style-type: none"> - Project Name: Incheon North port solar plant - Capacity: 3MW - Completion Date: 2014/05/12 - Type: Rooftop | Residential & Port area, Korea |  |

| | | | |
|---|--|--------------------------------|---|
| 5 | <ul style="list-style-type: none"> - Project Name: Fish Island solar plant - Capacity: 3MW - Completion Date: 2014/05/09 - Type: Ground fixed | Island area, Korea |  |
| 6 | <ul style="list-style-type: none"> - Project Name: Sangju floating solar plant - Capacity: 6MW - Completion Date: 2015/06/30 - Type: Floating System | In irrigation reservoir, Korea |  |

- 34.0 Is it safe to put 34.5kV lines overhead?
TGE is designing overhead and underground transmission interconnections that meet all codes and standards. GPA will also review and approve TGE designs before installation and acquiring custody of the line.
- 35.0 Construction phase traffic is a concern; there will be many deliveries for 230k panels, etc. The materials and equipment to be transported to site will not be delivered at once. It will be delivered on a staggered basis according to the project schedule. So, we expect that it will not cause traffic disruption. But, in order to minimize traffic disruption that may occur, we will deliver the materials and equipment in a time when traffic volume is low. And, we will arrange the person who controls safety during transportation to minimize traffic disruption. If it is necessary, we will support the delivery schedule.
- 36.0 The access road condition must be maintained.
LG CNS is committed to repair any damage to the road it is directly responsible for. This road is under the jurisdiction of DPW and ultimately they retain jurisdiction and responsibility for maintenance.
- 37.0 Does LG have a Real Estate development division? Could they reconsider this property for a resort development and put the solar facility in another location? Maybe on Gov. Guam land?
Unfortunately this is not possible. The property proposed for this project was part of a formal tender submitted to GPA. Changing the project site will result in a material change to LG's formal proposal than may disqualify LG from proceeding with a contract award.
- 38.0 Endangered snails and butterflies have been found and documented on adjacent property. What will be the protection plan?

It is worthy to note, TGE and its Biological team consultant early in the project planning stages and siting considerations screened the site for environmental constraints and decided in part to locate the facility footprint away from more rugged karst limestone forest topography at the north end of the property (vicinity of Marbo cave) in order to avoid habitat that had a greater potential for presence of listed species.

The same planning effort and avoidance strategy was used actually along the coastline but as we discussed more for reasons of historic cultural resource concerns.

Evaluation of potential for impacts to the two (2) federally endangered butterflies resulting from the proposed construction of solar energy facility at Marbo.

Mariana wandering butterfly (*Vagrans egistina*)

| | |
|---|-----------------------------------|
| Host Plant: | Native <i>Maytenus thompsonii</i> |
| Host Plant habitat: | Primary and secondary forest |
| Number of host plants recorded: | Four (4) |
| Number of <i>Vagrans egistina</i> recorded: | None |

Summary of Anticipated Impacts

Vagrans egistina has not been recorded on Guam since 1979 (USWFS Undated). No adult specimens, eggs, larvae or pupae were observed during surveys of the subject site. Host plants were recorded in four locations. Host plants are considered fairly common, therefore it is thought that this butterfly species has disappeared for reasons unrelated to host plant availability (Lindstrom and Benedict 2014). Given this butterfly has not been recorded for 38 years and is considered extirpated on Guam, the proposed project will have no direct or indirect impact upon *Vagrans egistina*.

Mariana eight-spot butterfly (*Hypolimnys octocula marianensis*)

| | |
|--|--|
| Host Plants: | Natives <i>Procris pedunculata</i> , <i>Elatostema calcareum</i> |
| Host Plant habitat: | Moist primary limestone forest featuring high relief karst |
| Number of host plants recorded: | None |
| Number of <i>H. octocula marianensis</i> recorded: | None |

Summary of Anticipated Impacts

No *Hypolimnys octocula marianensis* eggs, larvae, pupae or adults were observed during surveys of the subject site. No host plants were recorded. The specialized habitat where the two host plants are most commonly found, moist primary forest with steep and rugged karst features inaccessible to ungulates (Lindstrom and Benedict 2014), was not encountered on survey transects. The butterfly was purportedly recorded on a neighboring property across the main access road from the subject site. While the date and exact location of this sighting is not known at this time, areas fitting this description would likely be closer to the toe of the cliff line to the north and east where more rugged limestone habitat occurs.

The abundance of ungulates present together with historical human disturbances to include clearing, grading (US military, SOHBU Resort and recent housing developer), burning and farming/ranching documented in a Phase I Environmental Site Assessment by ARC Environmental Services (2017) completed for the project, may have altered conditions resulting in the absence of host plants and habitat that might have been present historically. The documented close association between *H. octocula marianensis*, its host plants and the limited specialized habitat that they are found within, is known to be a vulnerability affecting their survival and a key conservation consideration (Shreiner and Nafus 1997).

While the little is known about the two (2) host plants abundance island wide, they are considered to be uncommon in their range and vulnerable to ungulate grazing (USFWS 2013). Given the absence of host plants and specialized karst forest habitat within the project footprint, and the availability of undisturbed, suitable habitat along the surrounding embayment and coastline, it is anticipated that the proposed project to construct a solar energy facility will have no significant direct or indirect impacts upon *H. octocula marianensis*.

References

ARC Environmental Services. Phase I Environmental Site Assessment Lot No. 1 TRACT 1541 Mangilao. Final Report 2017.
Lindstrom, D. P. and J. C. Benedict. 2014. Final Project Report Federal Candidate Species Surveys on Guam. College of Natural and Applied Sciences, University of Guam Mangilao.
Shreiner, I. and D. Nafus. 1997. Butterflies of Micronesia. Agricultural Experiment Station, College of Agriculture and Life Sciences, University of Guam Mangilao.
USFWS. 2013. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form.
USFWS. Undated. Final Mariana Wandering Butterfly Poster.

- 39.0 Is there any impact to existing ROW and access roads, for example to the Marbo Cave area?
TGE has confirmed that all Rights-of-Ways, easements and access to shorelines have been protected and preserved. And, Doc. 912246 dated Sep. 12, 2017 shows public access to Marbo cave.
- 40.0 There is a 12" water line - has the water line been charged?
TGE has knowledge of this line being used for construction purposes in the past. TGE cannot confirm what is the operating status of the line.
- 41.0 We have a 2" line extended to the right of the intersection.
TGE has not formally conducted surveys of existing underground utilities and we cannot confirm this line exists.
- 42.0 Will the Marbo cave area be kept open for public use?
TGE has indicated Marbo Cave is not part of the project property—it is owned by others. The project however, protects and preserves existing easements and ROW to the Marbo Cave area. And, Doc. 912246 dated Sep. 12, 2017 shows public access to Marbo cave.
- 43.0 What are the advantages / disadvantages to OH and UG transmission lines, why not put the new lines underground?
Although the underground lines are better than overhead lines for their reliability, overhead lines are less expensive (which would impact GPA's LEAC positively) and easier to inspect, repair and maintain than underground lines. Also, our interconnection configuration has been carefully reviewed by Guam Power Authority and we believe mixing underground and overhead lines is the most efficient method for GPA and the people of Guam.
- 44.0 Are there any safety issues with the connection of this facility to the GPA grid?
The 3rd party expert has been conducting system impact study regarding the connection of our solar farm to the GPA grid, and we will design and construct the solar farm in compliance with the result of the study and other applicable regulations.
- 45.0 The current plan has 8-containers of batteries and approx. 230k panels to be installed at the site.
The project design will house the battery modules indoors and no containers will be used. Approximately 221,760 PV modules (panels) currently are estimated for implementation.

- 46.0 How are the batteries monitored and what is the response time if there are operations problems at the site?
Since it is detected by an electric signal, when a problem occurs, the cutoff measure will be made from several milli-seconds to several tens of milli-seconds. Please refer to Attachment #3 of the monitoring system for Batteries and PV modules.
- 47.0 How are the panels maintained, cleaned? Will there be chemicals used for maintenance?
Basically, modules are cleaned naturally by precipitation. IT is planned to conduct cleaning works 1-2 times a year in the dry season. Fresh water and no chemical materials will be used for cleaning.
- 48.0 What is the liquid volume needed for cleaning?
We assume four (4) 20-ton sprinkler trucks are required for cleaning the solar plant (0.35L per module).
- 49.0 How many jobs will be created by the project?
LG CNS expects to employ about 250 people in the construction phase and about 10 people in the O & M phase.
- 50.0 Will there be a fence at the property perimeter?
Yes. Perimeter fencing will be installed.
- 51.0 Can power be supplied to the neighbors?
PPA only allows us to sell the power to GPA.
- 52.0 There used to be sanitary sewer in the valley from the US Navy.
The project site will not use the Navy sanitary sewer system. This is a Navy system and that is not typically available for civilian use. TGE is aware the Navy sewer system has been out of service for many years and it may be in disrepair.
- 53.0 What will be the benefit to the community?
In the case of power supply for neighbors, in principal, it is the duty of the GPA. And, this solar project provides benefits to the entire island of Guam through GPA. It will help provide annual saving of more the \$35M in the first five years. GPA has predicted this will hedge against rising fuel oil prices in the future and help all residence of Guam reduce their cost of energy. Nevertheless, of course, we should discuss with the GPA at first, but KEPCO-LG CNS hopes that the Mayor of Mangilao collects the opinions of the neighbors about the range and level of the specific power supply they want, and we will do our best and make the most possible ways for cooperation with the community.
- 54.0 The CCU article recently in the news discussed the GPA cost savings but it seemed negligible compared to the revenue by KEPCO – LG over 25-years.
GPA has presented there is a net present value (that is over the 25-year term of this contract) the savings far outweigh the costs to ratepayers.
- 55.0 The contract protest is pending a decision by the OPA.
It is still under OPA review. We will update the information after the decision.
- 56.0 Is the sign properly updated with all GLUC application info? Yes.

- 57.0 What law / code allows "industrial" use for power in an "A" zone?
DLM has quoted under Conditional Use for an A-Zone, solar facility is determined to be under utility use and therefore it qualifies under current land uses regulations.
- 58.0 Is solar power generation classified as a "Utility"? Yes.
- 59.0 The project benefits have been explained but there is no negative impact identified?
The project provides the best and right choice for land used overall. Any positive benefits far out way negative impacts due to construction. For example, TGE has considered:
- Mitigating view shed issues by using the natural topographic of the site and designing low profile solar panels
 - Perimeter fencing will also be colored keyed to match surrounding vegetation
 - Landscaping along perimeter fence will also use native plants to mitigate view shed issues.
 - Existing dense jungle will be maintained; again to mitigate any view shed issues.
 - Clearing & grading of existing vegetation will be mulched to distribute to farmers and or green-waste landfill to help avoid proliferation of invasive species such as the rhino beetle or the fire ant.
 - Archaeological Monitoring Plan has been approved by Guam State Historical Preservation Office (GSHPO) to monitor any construction activity for cultural deposits, categorize them to determine how they will be documented and treated.
 - Biological surveys have determined no listed plants or animals are affected,
 - Illegal dumping of solid waste and garbage will be disposed of at approved and permitted landfill.
- 60.0 What is the project impact on adjacent land values?
TGE has retained the expertise to assess the impact of land values of the adjacent properties due to the development. This study will be made available to the GLUC prior to its public hearing for its review once completed.

ATTACHMENT #1

TEST REPORT

Zip Code 46762 5, MyongjiOceanCity-9ro, Gangseogu, Busan, Korea TET(051)464-0771 FAX(051)462-2115

Test Report No : TAP-010878

Receipt Date : May 17, 2017

Representative : Cho SungJin, Jung DoHyun

Test completion Date : June 14, 2017

Company : LG Electronics Inc.

Address : 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea

Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|--------------|--------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| flavor | - | - | O.K. | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| smell | - | - | O.K. | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| chromatality | degree | - | Below 0.1 | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| turbidity | NTU | - | 0.05 | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Arsenic | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| cadmium | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

-Next Page-

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June 14, 2017

CHIEF OF KOREA TESTING & RESEARCH INSTITUTE

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|------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| Cr ⁶⁺ | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Cu | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Pb | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Se | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Zn | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Fe | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

-Next Page-

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| Test Result | | | | |
|----------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| Hg | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Mn | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Na | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,2-dichloroethane | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,2-dichloroethylene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,2-trichloroethane | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

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Preparation : Lee Woomi
E-mail : umi3931@ktr.or.kr

Technical Director : Kim Jaehong
Tel : 1577-0091(ARS ☎->◎)

June 14, 2017

CHIEF OF KOREA TESTING & RESEARCH INSTITUTE

TEST REPORT

Zip Code 46762 5, MyongjiOceanCity-9ro, Gangseogu, Busan, Korea TET(051)464-0771 FAX(051)462-2115

Test Report No : TAP-010878

Representative : Cho SungJin, Jung DoHyun

Company : LG Electronics Inc.

Address : 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea

Receipt Date : May 17, 2017

Test completion Date : June 14, 2017

Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|--------------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| Trichloroethylene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Benzene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,1,1-trichloroethane | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| dichloromethane | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| cis-1,2-dichloroethylene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| tetrachloroethylene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

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Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|---------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| epichlorohydrin | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| vinyl acetate | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| Styrene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,2-butadiene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 1,3-butadiene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| N,N-dimethylaniline | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

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Company : LG Electronics Inc.

Address : 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea

Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|------------------------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| carbon tetrachloride | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| phenols | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| cyan | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| fluorine | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| formaldehyde | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| potassium permanganate consumption | mg/L | - | Below 0.3 | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

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Test completion Date : June 14, 2017

Company : LG Electronics Inc.

Address : 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Korea

Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|-----------------------------------|------|-----------------------|---------------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| 2,4-Diaminotoluene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| 2,6-Diaminotoluene | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| nitric nitrogen, nitrite nitrogen | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| anionic surfactant | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| chloride ion | mg/L | - | Non-detection | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| evaporation residue | mg/L | - | 15 | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |

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Name of sample : PV Module(LGxxxN2W-A5)

| Test Result | | | | |
|-------------------|------|-----------------------|---------|--|
| Test Item | Unit | Sample classification | Results | Test Method |
| residual chlorine | mg/L | - | 0.20 | Process test method for Hygienic safety standards of water-based materials and products : 2015(Ministry of Environment Notice No.2015-103) |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Contact area : Above 50 cm² /L

* Purpose : For Quality management

Remark : 1. This test report is a test result of the sample and the sample name presented by the applicant and does not guarantee the quality of the whole product. Verification of the report can be confirmed by the homepage(www.ktr.or.kr) or QR code.

2. This test report can not be used for publicity, propaganda, advertising, litigation, etc.

3. This report is only valid for original (including certified copy), and copies and electronic copies / file are for reference only

Preparation : Lee Woomi

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June 14, 2017

CHIEF OF KOREA TESTING & RESEARCH INSTITUTE

ATTACHMENT #2

4. Safety

4-2. Cell Safety

- LGC acquired international certificates(UL, CE, UN/DOT) as well as local certificates (SBA)

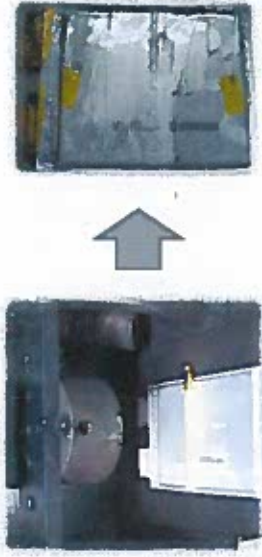


| Standard (Nation) | IEC 62133 (Europe) | UL 1642 (USA) | UN 38.3 (USA) | SBA S1101 (Japan) |
|----------------------|-----------------------|-----------------------|------------------|-------------------------|
| Overcharge | - | - | - | SOC0, 5.0V CC charge |
| Hot box | 130°C, 30min. | 130°C, 10min. | - | 85°C, 180min. |
| Crush | 13kN, Flat | 13kN, Flat/Side | - | - |
| Impact | - | Φ15.8mm, 9.1kg, 610mm | | |
| External Short | 80mΩ, 10/45°C | 80mΩ, 20/55°C | 80mΩ, 55°C | 30mΩ, 25°C |
| Nail | - | - | - | Φ3 , 80mm/sec |

Neither fire nor explosion under the test condition above.

Cell Safety

- No fire or explosion throughout all safety tests

| Overcharge | Hot box | Crush |
|---|--|---|
|  |  |  |
| SOC0, 6.3V, CC charge | 130°C, 30min. | 13kN, Flat/Side |

| Impact | External Short | Nail |
|--|---|--|
|  |  |  |
| Φ15.8mm, 9.1kg, 610mm | 5mΩ, 25°C | Φ3mm , 80mm/sec |


Passed all tests

4-3. Module Safety

- [illegible]

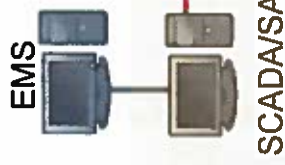
Module Safety

- No fire or explosion throughout all safety tests

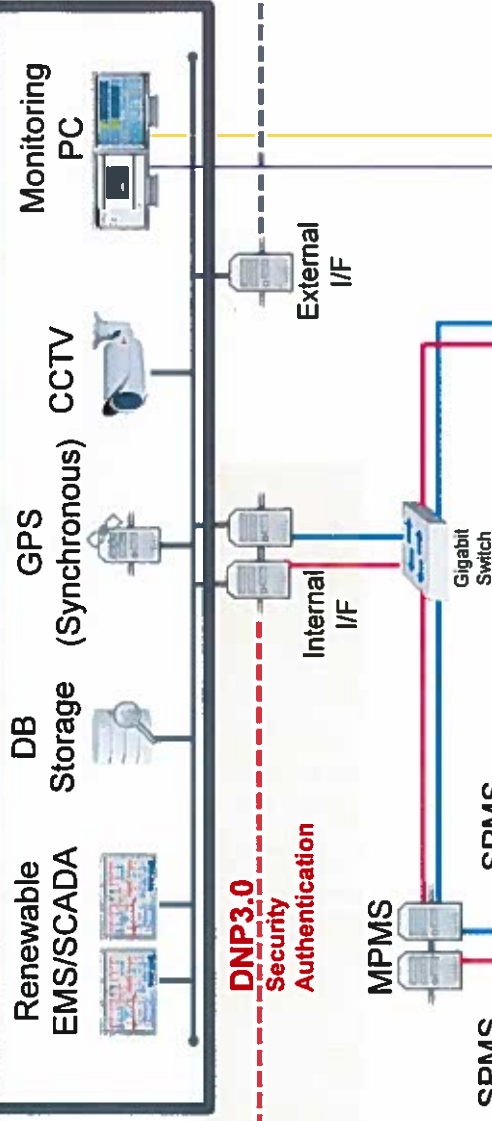
| Water Plunge | | Fire Exposure | | Vibration | |
|---|--|--|--|---|--|
|  | |  | |  | |
| KBIA | | KMOVSS | | UN38.3 | |
| External Short Circuit | | Fire Propagation/Suppression | | | |
|  | |  | | | |
| UN38.8 | | LG Chem | | | |
| | |  | | | |
| | | Drop | | | |
| | | LG Chem | | | |

ATTACHMENT #3

GPA



Renewable Control System



DNP3.0
Security
Authentication

MPMS

SPMS

SPMS

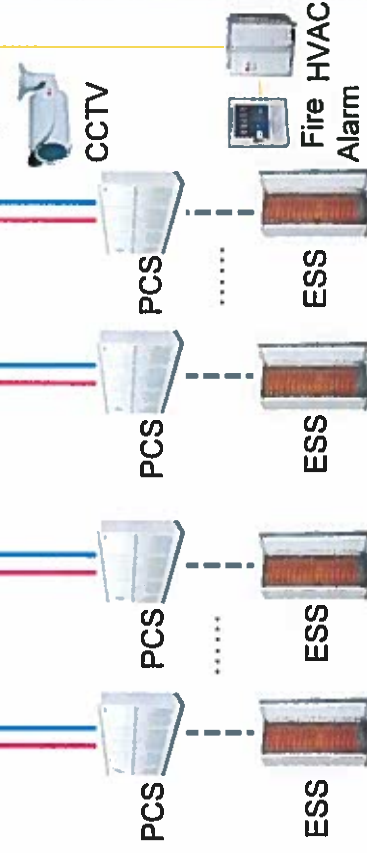
Internal I/F
Gigabit Switch

External

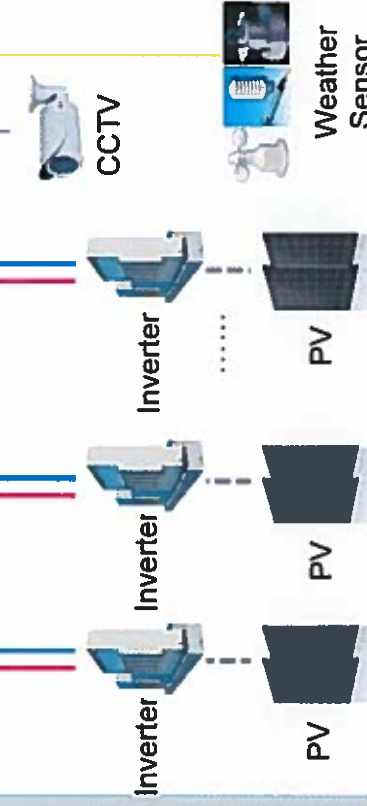
Monitoring for
Batteries and PV
Modules



ESS



PV System



Modbus/RSTP 1st/Opt Ethernet
Modbus/RSTP 2nd/Opt Ethernet
RTSP/Ethernet
BACnet/RS485

MANGILAO MUNICIPAL PLANNING COUNCIL

MINUTES OF JANUARY 4, 2018 SPECIAL MEETING 6:00 pm, Community Center

I. CALL TO ORDER

A special meeting of the Mangilao Municipal Planning Council (MMPC) was held on Thursday, Jan. 4, 2018, at 6:00 p.m. in the Community Center. Mayor Allan G. Uyugan presided as the Chairman of the Council.

II. ATTENDANCE

Present included: Liz Actalie, John Aguon, Ray Blas, Ben Carbullida, Dominic Muna, Darlene Taliano, Rosita Tosco. Attending from the Mayor's Office were Vice Mayor Tommy Duenas, Ms. Vanessa Aguero, Ms. Jemette (Len) Munoz, Clarissa Borja, Nick Campos, and May Erickson.

Special guests from TG Engineers, PC and KEPCO & LG CNS: Mr. Joaquin "Kin" Flores, Mr. Tor Gudmundsen, Mr. Chung Kook Choi, Mr. Ji Sug Chung, and Mr. Sung Ho Ryu. Also present were: Mr. Ted Nelson, Jr., Mr. Marvin Scharff, P.J. Aguon, and Jane Gatchon.

III. SECRETARY'S REPORT

No Minutes for December 11, 2017 meeting; no quorum.

IV. TREASURER'S REPORT -- None.

V. NEW BUSINESS -- None.

VI. OLD BUSINESS

I. Solar Plant Photovoltaic Facility

Mr. Joaquin "Kin" Flores noted that the TLU hearing for this project, that was scheduled last month, had been extended/continued for next Thursday Jan. 11. He asked for the Mayor and Council's support. Mr. Flores stated that a conditional land use permit had already been obtained from LPA for the clearing and grading of the property.

Mr. Chung Kook Choi, General Manager for KEPCO, indicated his company is willing to help support activities that were beneficial to the village as a whole. The Mayor had earlier voiced his concern relative to the several residences in the area that were requesting utility services from government agencies. He would like to provide them an opportunity to get on the grid with the understanding that each individual is responsible to apply for power/water, in the event of any development.

Mr. Ted Nelson Jr. spoke before the Council, apologizing for part of his families' comments during the town hall meeting. Several of his family members did not want the facility built in the area. He indicated that although they own properties there, most of them do not reside in the area, nor do they even vote in Mangilao. He felt that KEPCO is not obligated to provide power and water to their residences. He informed the council that to his knowledge, there was no petition circulating against the project.

some of his relatives were not in favor of having the facility built there due to environmental, historical and cultural issues.

Mr. Flores asked if the Mayor and the council have identified projects that their company can assist with that would be beneficial to the village. For example: KEPCO can adopt the Route 15 area: maintaining the road and side streets, parks (picking up solid waste, trash, cutting grass, etc.); installing proper lightings; traffic signals in key intersections throughout the village. Mr. Flores and council members Dominic Muna and Ben Carbullido agreed that before traffic lights are installed in intersections, a study on the flow of traffic need to be assessed. In the meantime, crosswalks may be placed on the four corners of the intersection for safety and accessibility.

Mr. Choi indicated that seven (7) motion sensor cameras will be installed to monitor the road area. Also, he noted that his company may not be able to install street lights but that with joint funding with other agencies or grants, they are willing to give their support and provide assistance.

Mr. Dominic Muna suggested that perhaps the company can establish some kind of financial support to be given to the Mayor's Office for the Mayor to use for community projects at his discretion. Mr. Flores and Mr. Choi both agreed that at the present time this was not a feasible plan.

Mr. Dominic Muna made a motion for the Mayor and the Council to determine which issues or projects that KEPCO may support that will benefit the community; including maintaining the Rte 15 area, keeping it clean and providing safety/security, street lights, crosswalks, cameras.

The motion was seconded by Mr. Ben Carbullido; unanimously approved.

VII. ANNOUNCEMENTS

Guam Land Use Commission (GLUC) meeting is scheduled for Thursday, Jan. 11. The Mayor has been invited to attend; as well as the Mayors from the surrounding villages.

VIII. ADJOURNMENT

Mr. Ben Carbullido made a motion to adjourn; seconded by Ms. Liz Acialla; unanimously approved. Meeting adjourned at 7:50pm.

Respectfully submitted,

Rosita D. Tosco, Secretary
Date: Jan 10, 2018

ATTESTED TO:

ALLAN G. UNGACTA, Chairman
MANGILAO MUNICIPAL PLANNING COUNCIL

1st 9

LANDSCAPE TO CHANCE - EASY SASAYAN TODAY - A Photographus Paradise









